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INTERNATIONAL INSTITUTE OF AGRICULTURE  
BUREAU OF AGRICULTURAL INTELLIGENCE AND PLANT DISEASES

# INTERNATIONAL REVIEW OF THE SCIENCE AND PRACTICE OF AGRICULTURE

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The Bureau assumes no responsibility with regard to the opinions and the results of experiments outlined in the Bulletin.

The Editor's notes are marked (*Ed.*).

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FIRST PART.  
ORIGINAL ARTICLES

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**The Present State of the Livestock Industry in Algeria**

by G. TROUETTE

*Veterinary Surgeon, Professor of Economic Zoology at the Algerian School of Agriculture.*

On account of its topography, its configuration and its limits, the sea at the north and the desert at the south, Algeria shows various climatic conditions and distinct zones that have limited the distribution of its animal population.

In the Sahels zone, a region of hills extending along the mediterranean shore, all the domestic animals are found together.

The region of low plains (Mitidja, Macta, Bône) formerly supported numerous cattle which have been driven by vine-growing towards more elevated land (Mina, Eghriz, Ain-Bessem, Sétif, Constantine, Guelma). These plains, from 1900 to 3250 metres in altitude, include the best centres for breeding horses and mules, and during the summer, provide food for the great part of the migratory flocks of sheep, driven by the drought and heat of the season from the real high plateaux.

The latter form steppes, with an irregular and scanty water supply and whose clayey-sandy soil supports a dwarf and shrubby vegetation suitable only for the food of sheep and camels.

The woods in the mountains overlooking both low and high-lying plains, provide shelter for the major part of the flocks of goats.

Over an area of 50 million hectares are spread about 15 million head of livestock. At present rates they represent about 500 million francs.

The importance of these figures is considerably diminished on noting that over an equal area in France in 1913 were spread 46 million animals worth over 5000 million francs, and that each sq. km. of the capital supported 12.083 kg. of domestic animal matter while the Algerian soil only supported 1.544 kg.



If France and Algeria may be compared as to their surfaces, they can neither be compared as to other agricultural subjects, nor as to their methods of breeding.

Great differences also exist between the forage resources of the metropolis and Algeria; in the former abundant and varied, in the latter almost uniform.

The natives keep the greater part of the livestock and possess 10 times more domestic animals than the Europeans.

*Animals in 1913.*

	to Europeans	belonging to Natives	Totals
Horses . . . . .	61 866	154 179	216 045
Mules . . . . .	57 502	137 231	194 733
Donkeys . . . . .	8 627	262 878	271 505
Cattle . . . . .	170 108	937 485	1 107 593
Sheep . . . . .	772 014	8 038 725	8 810 739
Goats . . . . .	89 599	3 758 202	3 847 801
Pigs . . . . .	111 995	15	112 010
Camels . . . . .	240	184 578	184 818
Totals . . .	1 271 951	13 473 293	14 745 244

This fact alone suffices to explain that breeding in Algeria is not so developed as the same industry in Australia and South America, even if not considering the advantages of environment, which are more suitable to stock rearing in the latter countries than in Northern Africa.

In fact, numerical development is closely related to hygiene and feeding. Thus, if one finds the Algerian colonist well provided with suitable housing and sufficient reserve food to enable him to tide his animals over the bad season, it is by no means so with the native. The latter, faithful to the maxim that "Allah who created me, protects me", provides neither shelter nor reserve food for his livestock. The rain and the temperature contro the condition of his flocks and herds. If the winter is severe or there is a lack of water, the animals die in great numbers through cold and hunger. If, on the other hand, rain is plentiful and the winter mild for several years, pasturage is not wanting and the herds increase; but only one year of dearth is required for the herds to decrease, while several years of abundance are necessary to make good the loss.

The livestock belonging to Europeans increases regularly, while that of the natives remains more or less stationary.

	Animals belonging	
	to Europeans	to Natives
In 1890 . . . . .	594 590	13 834 828
In 1900 . . . . .	725 723	12 497 877
In 1910 . . . . .	1 041 990	13 716 502

The improvement of the native breeds is hindered by the majority of Mussulmen because of their fatalistic indifference which can not be overcome, even as regards the horse, an animal for which the Koran imposes affection as a religious duty. Yet, in some few regions under the influence of the administrators and the contagious effect of example, the natives have made some progress in animal husbandry.

In addition, the improvement of the domestic animals belonging to the European colonists has long been retarded by forgetting the influence of environment and feeding, disregard of the laws of heredity, unthinking belief in prejudices, occasionally too by the severe effects of contagious diseases, not understood and lacking specific treatment.

Such as they are, the domestic animals and their products occasion transactions which, in 1913, by reaching a total of 88 million francs, have gained the second place in the export trade of Algeria. Out of that sum, 72 millions represent the share of France, 7 million those of foreign countries, while 10 millions result from exports to Morocco and Tunis.

The imports of livestock are smaller; the value, in 1913, amounting to 18 million francs.

On simply examining these commercial statistics, one would be tempted to conclude that the condition of the livestock industry in Algeria is in a good condition. But if it is remembered that the imports are principally milking and working animals, and fresh and prepared food, it is seen that Algeria lacks good working animals, deep milkers, and at certain periods at least, food for consumption.

The inference is correct, and leads to the examination of each species of Algerian domestic animal, of their defects and qualities, and to an account of the usual methods or those to be used in order to minimise the former and increase the latter.

**HORSES.** — The Algerian horse is usually described as the *Barbary* horse. Riders blame it as having a rather heavy head, flabby cruppers, thin thighs, flat sides, bunched-up legs, an ugly and short step. They forget its strong back and withers, its deep chest, its fine clean legs, and also its courage, vigour, simple habits and endurance, which make it the finest cavalry horse in the world. — Growers and carting contractors justly say that the Barbary horse is not a quiet worker and lacks the strength and weight needed for continuous effort. Its improvement is thus required, but in different ways, by all those using it.



*Export of livestock and their products in 1913.*

	No. of Head.	Value in fr.		Quintals (1)	Value
Horses . . . .	3 433	1 341 000	Fresh meat . .	68	11 000
Mules . . . .	1 755	1 053 000	Salted " . .	1 185	167 000
Donkeys . . . .	3 535	159 000	Pork, etc. . .	161	53 000
Cattle . . . .	44 711	10 039 000	Fats . . . . .	2 607	266 000
Sheep . . . .	1 190 348	40 756 000	Raw Skins . .	51 936	10 777 000
Goats . . . .	2 147	43 000	Wools . . . .	97 892	13 195 000
Pigs . . . . .	8 246	927 000	Various . . .	21 248	458 000
		63 318 000			24 927 000
Total Value . . . 88 245 000 fr.					

Breeders wishing to improve its shape and size have, after some trials, settled upon the Breton stallions, whose temper, simple habits, endurance, compact form, combine perfectly with the qualities of the native race.

The chief regions occupied in this industry are Philippeville, Sétif, Batna, Mitidja, Tlemcen, Triaret. The results of experiments have given encouraging results.

**MULES.** — This industry uses about 20 000 mares in Algeria. They are mated with either native jacks or those occasionally imported from Poitou, more often from the Pyrenees, Catalonia or Savoy. The districts of Sétif, Constantine, Tlemcen and Oran produce the most mules. This industry gives quicker and surer returns than those obtained in horse-breeding. Besides, the demand and prices offered for mules are continually increasing. Thus the natives are devoting themselves more and more to this industry. Many see danger here for horse-breeding, as they do for rearing draught horses. Yet there is room in Algeria for all three industries: war horse, draught horse and mule. They do not exclude one another, but on the contrary, do not supplement each other, as they do not interest the same factors. As Algeria possesses native mares of various types, it is more rational to utilise them according to their aptitudes.

**DONKEYS.** — These are very important to the natives for means of transport. Before 1916 they were never in much demand on the market. The French War Minister bought 5000 in that year as pack-animals. But this temporary market will have little effect on their improvement. Besides they are splendidly adapted to the life of privation and work that they live under the Arabs. A few choice specimens, 1 metre 30 cm. in height, have received special care as being stud jacks.

**CATTLE.** — In spite of the morphological differences between the cattle of the East (Guelma) and those of the West (Oran), most writers derive Algerian cattle from a single branch. The result of undirected breeding,

(1) 1 Quintal = 220 lbs.

vigorous and active, quiet and hardy, they lack early maturity, weight and milking capacity. The alternating seasons of long dearth and short periods of abundance retard their development, so that they only become mature at 7 years, but do not change their faculty of assimilation, so that 3 months of good pasturage suffices to change them from almost emaciation to a good condition of fatness. The best specimens then weigh from 360 to 400 kg., while the average weight varies between 250 and 300 kg. The size of these animals is thus insufficient for draught purposes, in spite of their untiring energy.

Cows. — The native cows are very poor milkers and moreover will not stand to be milked in the absence of their calf. This has led to the introduction of French dairy animals, in order to increase the milking powers of the Arab cows (Guelma), or better, as time allows, to replace them by crosses with the imported breeds (Sétif-Souk-Ahras).

The latter procedure tends simultaneously to increase the type. It has been tried with various breeds, and experiments showed that the Durham is unsuited to Algeria; that the Charollais breed gives good working and butchers' animals (Aïn-Smara, Meskiana); that the Tarentais breed is perfectly suited to live in the Souk-Ahras regions; that the Schwytz at Sétif has remained true to type, while retaining its milking qualities; that the Norman and Montbéliard types cannot leave the breeder's stable.

But these isolated experiments as yet have had no great influence on the general condition of the cattle as a whole. It will only be entirely improved when sufficient reserve food will have been grown on each farm, whether European or native, to provide abundance of healthy food for the animals in any season. Again, crossing can not be usefully undertaken until science has found remedies against *Piroplasmosis*, a disease sometimes destroying, in a few weeks, the results of several years.

SHEEP. — Without considering the breeder's varieties, Algerian flocks can be divided into a fixed group, a group of limited migration, and a group of extensive migration. Their number, like those of cattle, depend on the effects of good and bad seasons or years. Dearth and a severe season causes a decrease of up to 50 per cent of the numbers of the extensive migration flocks, while the others rarely lose more than 10 per cent. of their numbers.

A considerable mortality has notable effects upon the Export trade in sheep. The export usually amounts to one tenth of the total number, a part to which must be added the average accession of 150 000 head from Morocco. This trade provides the greatest part of the income (about 40 million fr.) of the native herdsmen. Thus, sheep provide the most important question of Algerian livestock breeding, both from economic and social points of view. For its resolution, it must be attempted: 1) to ensure the existence of the flock during dry years and severe winters; 2) to improve the yield and quantity of meat and also, as a side line, of the wool; 3) to increase the total number.

The first point can easily be solved for the fixed group, but less so for



the limited migrants, and this solution is quite impossible for the extensive migrants, as reserve food presupposes cultivation and settling in one place.

Improvement could be realised by continual and well directed selection of the nomad and semi-nomad flocks, whose essential ability for travel and primitive mode of life must be preserved.

Crossing with suitably chosen early maturity breeds would give good results in the fixed flocks.

If the total number can be increased with the fixed groups, it can not as yet attain, in the migratory flocks, the dense population obtained in New South Wales, Australia, the Cape, and in La Plata. The regions supporting the southern flocks seem to have attained their maximum capacity, for the constitution of native property has considerably reduced the common lands, and the absence of water renders extensive pasture regions unavailable. As it is not possible to create water supply everywhere, it is evident that exportation is a regulating operation for the migratory flock as it maintains the total number at the best point suitable with regard to the food actually available.

This exportation, which began about 1848, takes place from May 15 to the end of September. It commences from Oran which, on account of its latitude, has earlier vegetation. It continues by Algiers, and then by Constantine placed further north and at a higher elevation. The gross weight of the sheep exported is, at the time of leaving, about 41.5 kg., on the average, those from Algiers being the heaviest and those from Constantine the lightest.

To satisfy trade requirements, the natives who used to keep their sheep till 4 years old, now sell them at 3 years old at the latest. Of animals over that age, only the surplus ewes in the flock are kept. The replacing of exported or butchered animals or those dead from disease is thus ensured by this permanent excess.

Sheep rearing is particularly carried out for meat production. A cold store, which will be working in 1918, will give a further impetus to the aims of meat production.

CAMELS; GOATS. — Goats and camels share, together with sheep, the difficult conditions of existence in the south and on the high plateaux. They receive no care and are only differentiated from those in the wild state by their sociability and tractability. During their life, they are not the objects of any internal trade. Goat skins provide good recipients for the natives and are also in good demand for export, reaching 12 000 quintals per annum worth 3 500 000 francs.

These animals are most valuable to the natives on account of the milk, meat and wool they produce, while the camel is indispensable for transport in the south. Because of these facts, their breeding should be encouraged. It would, in addition, profit by all the improvements in feeding brought about for the breeding of sheep, the vicissitudes of whose life they share.

PIGS. — Pig breeding is carried out solely by the Europeans, as the Koran forbids it to the natives. However, this trade tends to become important, particularly at Oran. From Oran are exported half-fat pigs which are completely fattened in the neighbourhood of Marseilles. The export

number varies between 10 and 20 thousand. It could be very greatly increased for Algeria is well suited to the three stages in pig-breeding: production of sucking pigs and their sale after weaning; pasturage on common land till 50 to 60 kg. in weight; fattening up to the average weight for export or killed for the local pork butchering trade, when 90 to 100 kg. The market is quite safe as France and Algeria are large importers of pork products.

From this rapid summary of the present state of breeding in Algeria, it may be assumed that its improvement necessitates the consideration of urgent and complex questions.

Urgent, because without considering the special needs of Algeria, it is evident that the present crisis will greatly reduce the total live-stock of Europe. Algeria, who has already aided France in such a way as can only be adequately judged after the war, should at once get ready to give the help that will then be certainly asked for.

Complex, because these questions at the same time concern economics, agriculture, zootechny, administration, etc.

To resolve these problems suitably and fruitfully, the Governor General, M. LUTAUD, who is specially concerned with the development of agriculture in Algeria, founded in 1914 under the direction of M. BRUNEL, Director of Agriculture, Commerce and Colonisation, a special Commission uniting all the principal breeders and experts. Present conditions have prevented the commission from meeting. But already a general plan has been worked out including research and experimental work, in carrying out which the various Agricultural Departments and the Livestock breeding Department (soon to be founded) will collaborate with the interested parties of proprietors or groups of proprietors.



## SECOND PART. ABSTRACTS

### AGRICULTURAL INTELLIGENCE

#### GENERAL INFORMATION.

LEGISLATIVE  
AND ADMINI-  
STRATIVE  
MEASURES

- 1 - **International Yearbook of Agricultural Legislation.** — *International Institute of Agriculture, Rome 1916.*

The International Institute of Agriculture has published the fifth volume of the *Yearbook of Agricultural Legislation*, which contains the laws relating to agriculture published in the different countries of the world. The *Yearbook* is divided into : Legislation regarding statistics — Commercial legislation — Financial and Customs legislation — Laws concerning animal products — Laws regarding agricultural organisation — Laws concerning diseases and animal pests of plants — Legislation for cooperation, insurance and credit — Laws concerning Real-estate — Legislation regarding relations between capital and labour in agriculture — Legislation concerning rural hygiene and rural police.

Some brief indications of the most important laws published in the technical parts of the *Yearbook* may be given.

Chapter I of Part IV relates to laws for crops during the war and gives the whole text of the decrees of the German Empire of March 31, 1915 and September 9, 1915 with the object of providing for sowing down crops during the war. — The Austrian Empire published, on March 3, 1915, a decree to provide for the reclaiming of uncultivated land during the war, and on May 6, 1915, another decree providing for the utilisation of all the ground which is suitable for use as pasture. — France, by a decree of September 7, 1915, proposed to develop agricultural production during the war, by supporting the use of agricultural machinery by means of grants to aid purchase. — Greece, by a law dated October 28, 1915, has decided the rules to be followed for agricultural progress, in spite of the special conditions owing to present circumstances. — Italy, by a decree of June 3, 1915, has taken steps to assure the quick and steady execution of work

related to the crops, and by another decree of June 6, 1915, has authorised the Minister of Agriculture to buy agricultural motors and machinery and to give premiums to those associations which, by means of the implements they possess, undertake the methodical execution of agricultural work of general utility.

Chapter II of Part IV contains the measures taken to provide for the normal development of crops in general. It contains a law of the Argentine Republic of June 8, 1915, which obliges the Executive Committee of the Corn Exchange to buy seed for distribution to agriculturists unable to do so, and two laws of Manitoba (Canada) of March 10, 1915, with the object of providing seed for such agriculturists as are unable to obtain it directly. — In the chapter on forests, the *Yearbook* publishes the laws of the Grand-Duchy of Baden, China, New Hampshire (U. S. A.), Regency of Tunis, Greece and Uruguay, which deal with the administration of the forests, reafforestation, forests police, etc. The Chinese law of November 3, 1914, which organises forest administration throughout China and gives measures for reforestation, is of special interest.

Part V of the *Yearbook*, devoted to animal production and products, shows the legislative activities of the various countries to assist animal production and products. This activity is shown under: Measures for developing and improving Breeding. — Diseases of Animals. — Hunting and Fisheries. — Beekeeping and silkworm raising. — The English law of July 29, 1915, which has for object the maintenance of a certain number of livestock for the duration of the war, and for 12 months after the cessation of hostilities, deserves special attention. To attain this object, the law, which applies to Ireland, Scotland, Wales as well as England, authorises the Departments of Agriculture to prohibit or limit the slaughter of livestock, to prohibit or limit the sale of the meat of animals under a certain age, to give powers to local authorities to assure the administration of the law, etc. The Spanish law of December 18, 1914, and the regulation of June 4, 1915, regarding preventive measures and the control of diseases of animals are also important. The law and the regulation are divided into two categories: the first regulates the internal organisation of the Department for the control of diseases of animals and states the guiding principles to be followed for control; the second includes measures regulating the import and export of animals.

The measures taken in the various countries for regulating agricultural organisation and education are grouped together in Part VI of the *Yearbook*. The first class includes an ample set of legislative measures. It includes measures taken in order; to create state organisations for the guidance of agricultural production, or to modify existing institutions for that purpose; to found purely advisory bodies; to found public organs of local character in order to direct the activity of agriculturists according to modern technical principals from a practical point of view. A group of Brazilian decrees is also noted, of which, one of January 13, 1915, defines the functions of the Secretary of State for Agriculture, another of January 27, 1915, creates the Department of Animal Husbandry and regu-



lates its activities, while a third of April 6, 1915, regulates the functions of the Department of practical agriculture and a fourth, of Jan. 27, 1915, controls the working of the federated zootechnical Stations.

Part VII contains the regulations issued in 1915 for the control of plant diseases, weeds, and animals injurious to plantations, to control pests that have already appeared and to help agriculturists having suffered from the pests. Many of these regulations are in relation to the control and destruction of locusts; the most important laws are those of: Colombian Republic, November 15, 1915. — Costa Rica, June 3, 1915. — Philippine Islands, February 5, 1915 — Madagascar, October 5, 1915. — Guatamela June 5, 1915. Among other decrees given in this part of the *Yearbook* may be mentioned the French decree of February 5, 1916, extending the duties of the Department of Phytopathological Inspection, created by decree of May 1, 1911, modified under date of January 16, 1913, and which devotes this Department, at first limited to horticulture, to agricultural production in general. — A law of British Columbia (Canada), of March 6, 1915, contains regulations for the control of weeds, and a decree of Uruguay of January 16, 1915, regulates the carriage of plants in order to prevent the spread of plant diseases.

DEVELOPMENT  
OF  
AGRICULTURE  
IN DIFFERENT  
COUNTRIES

2 - **Agriculture in Guatemala** (1). — LEMUS MANUEL (Director General de Agricultura, Minería, Industria y Comercio), in *Centro America, Organó de Publicidad de la Oficina Internacional Centro-Americana*, Vol. VIII, No. 3, pp. 322-340, figures. Guatemala, July-September 1916.

The territory of Guatemala, covering 109 960 sq. km. has a very varied topographical outline; between altitudes from sea-level to 4600 m., it has: large areas sloping gradually from 800 m. to the sea on the sides towards the Pacific and Atlantic — high plateaux from 800 to 1500 m. — mountains between 1500 and 460 m. — and three varieties of climate corresponding to these three zones: torrid — temperate — relatively cold. In consequence of the variety of soil and climate, it possesses a very rich fauna and flora and is suitable for the cultivation of the most varied crops. It has rich mineral resources, but agriculture constitutes its main source of prosperity.

**CEREALS.** — Maize is the chief cereal cultivated in the 3 climatic zones of the country: it may be said that it is to be found on every farm, but it is chiefly grown by the Indians. The production, in normal years, (2 761 000 metric quintals), suffices for local consumption and forms the principal basal food of the country. If better methods of cultivation were adopted the production could be doubled.

Although the country has vast areas well suited for the growth of wheat and which might produce quantities in excess of that required for

(1) See also: *B.* 1910 p. 7; *B.* 1911, No. 714; *B.* 1913, No. 631.

The scientific names corresponding to the local names in the above paper have been added by the Editor with the help of the work by Dr MIGUEL COLMEIRO: *Diccionario de los diversos nombres vulgares de muchas plantas usuales o notables del antiguo y nuevo mundo*. Madrid, Gabriel Alhambra, 1871. (Ed.)

home consumption, yet Guatemala is partly dependent on external sources for wheat and wheat flour ; nevertheless the growth of wheat is spreading and will probably suffice, in a few years time, for the needs of the country.

Rice is grown in several districts and is of excellent quality, being superior to the imported rice ; again the production is insufficient for home requirements and could be much increased.

The same applies to Barley and Oats.

Three varieties of Sorghum are grown, which are mostly used as forage, but, in some localities, the seeds are mixed with those of maize at the rate of 25 to 50 % in order to make a sort of cake. Two varieties "maicillo blanco" and "maicillo rojo", are suitable for growing in dry soils, although they grow better in cool soils.

LEGUMINOUS PLANTS GROWN FOR SEED. — Beans, which with maize constitute the principal foods, are cultivated all over the country, usually on small areas. Many varieties are grown, the most common and best of which is the black variety. According to data collected by the "Jefaturas Politicas departamentales" the crop in average years is 85 000 quintals; this figure is below the reality, as it does not include the amount consumed on the farms themselves. Only small quantities of beans are imported and then of varieties not acclimatised in the country ; on the other hand, small amounts are exported from time to time to neighbouring republics.

Ordinary beans are especially cultivated in the cold zone ; the average yearly production is about 19 000 quintals. Peas, lentils and chick peas are grown and consumed on a limited scale.

FORAGE PLANTS. — For breeding and fattening livestock are mostly used: natural hay — maize (either green, as grain, or after removal of the grain) — "zacatón" (*Epicampes macroura*) — "parà" (*Panicum molle*) sorghum — lucerne — trefoil: Several foreign leguminosae ; particularly soya, have just been introduced and are being tested.

TUBERS AND ROOTS. — The growth of the potato is not as widely spread as is desirable because of the diseases to which it is liable, thus large amounts of potatoes have to be imported.

Several excellent varieties of sweet potato (*Ipomoea Batatas*) are grown. This crop is almost entirely grown by the Indians, using primitive methods.

The "Manihot" or "Yuca" (*Manihot utilissima*) is, after the potato, the most common starchy plant.

The "Ñame" (*Colocasia antiquorum*) is somewhat grown, particularly in the department of Izabel, and is gradually spreading.

The "Yuquilla" (*Manihot carthaginensis*) does well in the temperate zone, but is cultivated on a small scale.

The "Malanga" (*Xanthosoma sagittifolium*) has been recently introduced and does well in the warm zone.

TEXTILE PLANTS. — Several are grown, especially cotton — "maguey", (*Agave americana*) — *Fourcroya gigantea* — "escobillo" — "kapok" (*Eriodendrum anfractuosum*) — and various species of *Musa*.

The native varieties of cotton have a brown or white fibre, but short



and thus little in demand. All the exotic varieties from "Sea Island" to Egyptian, from the Peruvian tree form to the "Caravonica", are acclimatised in Guatemala, without degeneration, even with benefit, as most of them have become long-lived varieties. The cotton crop has not been grown to its full extent because of 1) the diseases attacking cotton in low-lying and damp soils, where it would grow best; 2) the scarcity of manual labour at cropping time, which coincides with that of coffee; 3) the high rents of land.

Several species of *Agave* give fairly thin fibres, which are made into rope or similar articles; this industry exports a certain amount. Up to the present wild plants only have been used, but their cultivation has been commenced. "Escobillo" gives abundant fibre, easy to obtain, and grows so rapidly on low-lying ground that it becomes a weed in coffee and sugar cane plantations.

"Kapak" is very common, but not much gathered.

The growth of textile plants could be considerably developed in the Republic.

**PLANTS YIELDING OILS** — The wild oil-bearing plants of Guatemala are very numerous but few are regularly cultivated and then only on a small scale. Among these latter are: the coconut tree — sesame — *Arachis hypogaea* — "chan" (*Salvia chio*) producing the best drying oil known — "aguacate" (*Persea gratissima*) whose oil rivals that of the olive — flax — castor-oil plant. Among the wild oil bearing plants, the most important are: "corozo" (*Attalea Colume*) (1) used for the production of a cooking fat — "Jocote Marañon" whose kernels give a very delicate edible oil, while the pericarp of the fruits furnishes a strongly caustic resin — "pinón" (*Jatropha Curcas*) — "arbol del sebo" (*Myristica sebifera*) — "arrayan" (*Myristica cerifera*) — "chilicayote" (*Cucurbita ficifolia*) and another *Cucurbita* sp. called "pepitoria" are cultivated a little for their seed, used as a condiment; an edible oil can be extracted from these seeds.

**PLANTS YIELDING DYES.** — These are not cultivated; only a few of the wild plants are used, especially: "palo del Brasil" (*Caesalpinia brasiliensis*) — Logwood or "palo de tinte" (*Haematoxylon campechianum*) — "yema de uuevo" (*Lucuma Rivicoa*) — "tiñehamaca" — "jiquilite".

**PLANTS YIELDING TANNINS.** — There are many wild plants yielding tannin in the country, including: "quebracho" (*Aspidosperma Quebracho*) — "encino colorado" (*Quercus tinctoria*) — "mangle" (*Rhizophora Mangle*) — "Nacascalote" — "palo de Nance" — "pepita de Aguacate".

The plants most usually employed are: "encino colorado" and "nacascalote". None of these plants have been utilised under regular cultivation.

**PLANTS YIELDING RUBBER.** — 1500 quintals of rubber were exported from Guatemala in 1914. The greater part of the rubber crop is obtained from wild trees in the forests covering the Atlantic and Pacific Coasts; in

the two coastal regions fairly extensive rubber plantations have been established, but have not as yet commenced producing.

**STARCH YIELDING PLANTS.** — After coffee, sugar cane is the most important crop grown in Guatemala. In many plantations two crops are grown simultaneously. On adding to the latter those plantations solely growing sugar-cane, we get 1906 plantations covering 295 *caballerias* or 13222 hectares producing 92500 quintals of refined sugar or 136 000 quintals of crude sugar; more than 46000 quintals of the latter were exported in 1914. The principal sugar manufacturies of the country possess the most up-to-date machinery.

**STIMULANT, AROMATIC AND MEDICINAL PLANTS.** — Coffee constitutes the most important crop produced in the country and also the principal export. The following varieties or species are cultivated :

*Coffea arabica* (forms 85 % of total plants). *C. Maragogipe* — “ Bourbon ” coffee (1) — “ San Ramón ” coffee. *C. robusta* has recently been put under cultivation. In 1913, there were 2 076 planters occupying 2000 *caballerias* or 90 000 hectares; there were 77 880 700 coffee plants producing 424 867 quintals. The preparation of the crop is carried out according to the best and latest principles; excellent coffee being produced, obtaining much higher prices than Brazilian coffee. The crop is spreading but slowly, — owing to the lack of manual labour. The rent of land for growing coffee (mostly private property) varies between 320 and 640 fr. per hectare.

The Guatemala cocoa-plant is said to be the best in the world, but its growth has decreased as the planters find coffee-growing more profitable.

The Flora is very rich in medicinal plants, which are used for popular medical treatment; the official pharmacopœia only includes a small number.

**MARKET-GARDEN AND ORNAMENTAL PLANTS.** — All the year round all kinds of market-garden produce come to market, including produce from both tropical and cold zones. Market-gardening is only carried out on a small scale, often only for home use. Flower growing, carried out in the garden round nearly every house, has progressed greatly of late, and economically is very profitable; yet it is only carried out on small areas.

**FRUIT TREES.** — All the fruit trees of the warm, temperate or cold zones grow in Guatemala. Apple, pear, cherry, plum, quince, walnut, etc., all produce good fruit at altitudes between 800 and 4000 metres. Native trees are: citrus (orange, citron, sweet lime, etc.). — *Persea gratissima* — *Carica Papaya* — pineapple — custard apple (*Anona* sp.) — “ guanabana ” (*Anona montana* and *A. muricata*) — “ zapote ” (*Sapota Achras*) — “ mamey ” (*Mucuma mammosa*) — “ manzanillo ” (*Hypomane Mancinella*) — “ acerola ” (*Crataegus Azarolus* — “ ingerto ” — “ Jocote mario ” — cactus, etc. The most widely grown trees are the 3 species of banana: “ banano ” (*Musa sapientum*), “ platano ” (for cooking) *Musa paradisiaca* and “ guineo ”. In 1915, more than 5 million bunches of these 3 species were consumed in the country, 3 217 000 being

(1) See No 36 of this *Bulletin*.



exported in addition. The growth of the bread fruit trees (*Artocarpus* sp.) has been started along the northern coast and in the department of Izabal. Several large undertakings are solely devoted to specialised fruit-growing; the most important is the "United Fruit Company".

**FORESTS.** — From the forests of Peten about 4 million "caoba" plants (*Swietenia mahagoni*) were exported through Belice and Mexico; nearly 200 000 plants were exported from the ports of Livingstone and Puerto Barrio and nearly 50 000 from Puerto San José. From the department of Petén nearly 276 000 kg. of "chicle" are exported every year.

**BREEDING OF LIVESTOCK.** — Cattle are still imported, but in less number than formerly, and as breeding has rapidly progressed owing to milk and beef production, Guatemala will soon become an exporting country. The natural pastures are suited both to rearing and fattening stock.

Many proprietors have, with the help given by the Government, imported breeding animals belonging to the best milk or meat producing or working strains. Crossing with native breeds has given good practical results.

Good types of horses and mules exist, but few breeders devote themselves to such specialised work.

Sheep breeding has lost ground because of the competition of woollen cloth mixed with other fibres and sold more cheaply than the home article. Nevertheless some breeders have imported best type animals with a view to the development of sheep breeding.

Pigs, few in number, are mostly kept by the Indians. The production being sufficient for the needs of the population, there is no importation. Lately some well-bred animals have been imported and in consequence this industry will probably assume considerable importance.

3 - **The First Agricultural Demonstration Trains in Russia.** — БЕНЗИНЪ В. (BENZINE V.) in *Сельское Хозяйство и Архивоведство* (Agriculture and Forestry), Vol. CCLI, Year I, XXVI, May, June and August, pp. 10-30; 161-179; 506-521. Petrograd, 1916.

In Russia, the first agricultural demonstration train was established on the Vladikavkaz railway, which belongs to a private company. The idea of a such a movable agricultural museum and lecture room was suggested to the Railway Company in 1908 by the Don-Kouban-Tersk Agricultural Society (1). The Company, which had previously tried to encourage the development of some branch of agriculture among the numerous railway men, wrote in 1912 in a report of the general Direction that 40 per cent of the total goods carried by the railway system was formed by agricultural products, principally cereals and that it was to the interest of the railway company to cooperate in the agricultural development of the region; it indicated, as a means to be used, the creation of testing grounds in the railway stations, which should act, according to the needs of the locality as active centres of agricultural propaganda. Ten of these experimental fields were to be founded, and in addition, a silo was to be built at Beslau station in the

(1) As regards these special carriages for travelling instruction, see B. 1915, N. 676. (Ed.)

maize region. This proposal was received favourably by the general Direction, and not long after, the Agricultural Department nominated agricultural experts to organise the work of the first three experimental fields, which were to be established the same year.

In addition, the Railway Company exchanged ideas with the local Agricultural Societies and the Agricultural Department with good results, so that on September 26, 1913, the first agricultural train, made up of 11 carriages, could commence its itinerary on the Vladikavkaz Railway; it visited 48 stations in 48 days and about 60 000 people came to see it.

On account of the satisfactory result of this first trial, another train was organised in the spring of 1914 with the chief aim of selling the seeds of forage and kitchen-garden plants, insecticides, books on agriculture, etc.

The train was also utilised during the autumn. It then comprised 14 carriages: 1 for teaching material regarding field cultivation — 1 for economic zoology — 1 for fruit trees — 1 for beekeeping — 1 for poultry-keeping — 3 as platforms for agricultural machinery and implements — 1 for the sale of books on agriculture — 1 (second class) for the agricultural staff — 1 (first class) for dining room — 1 (fourth class) for the assistants — 1 as platform for exhibiting diagrams, etc., and for lectures — 1 cold storage car. The train was in commission for 66 days (Sept. 16 — November 21.); it stopped at 58 stations, and was visited by 41 586 persons, including: 12 601 agriculturists — 18 506 women — 20 464 scholars of both sexes accompanied by their teachers.

In the spring of 1916, the train was organised for the sale of seed, insecticides etc., selling a total value of 536 000 francs. The sale of seed gave such encouraging results that the Railway Company has decided to rent the necessary ground to produce the seeds of kitchen-garden plants, while the Agricultural Department will provide the seed. In consequence of such results, the Department has awarded a grant of 16 000 francs for the purchase of teaching-material, and the Railway Company has commenced building a lecture car 20 metres long, with a cinematograph, projection lantern, and to contain 200 persons. At present, the work of the train is carried on under a director who has 3 assistants and one agent for the sale of seed, etc., and who gets in touch with the local agricultural organisations to settle the propaganda work to be carried out in each district. The Author, who is now the director of the train, concludes his report thus:

1) Agricultural trains may become a powerful means for agricultural propaganda work, and contribute to the developement of all kinds of farms, particularly small farms.

2) The activity of this agricultural train ought to correspond to the real real needs of local agriculture and should as far as possible be always based on the results of local agricultural experiment stations and local farms showing the most progress.

3) The work of the train should be intimately connected with that of the local agricultural societies and with that of the States.

4) Given that the state of agriculture has a great influence on the goods-traffic, and consequently on the Railway returns, the Railway Com-



pany should regularly provide the expenses for the agricultural trains as a means favouring a greater use of the railways crossing the agricultural regions of Russia.

5) Given that each railway traverses several regions and provinces, each having its own agricultural society, it is necessary, when establishing an agricultural train, to establish also an agricultural organisation capable of carrying out the work in all the regions traversed by the railway, and in cooperation with the local societies.

6) Given the national importance of the agricultural trains, it is to be desired that, if they are to be instituted on all the railways, a special law should be passed concerning them and treating them as an institution.

In 1914, following the example of the Vladikavkaz Railway, the Moscow-Kazan Railway has instituted a special agricultural train, and the South East Railway organised in 1916 its first agricultural train for the sale of seed, etc.

#### AGRICULTURAL INSTITUTIONS

- 4 - **The Volunteer Cooperators of the U. S. Department of Agriculture for the Advancement of Farming.** — *U. S. Dep. of Agric. Weekly News Letter*, Vol. III, No. 46. Washington D. C., June, 21 1916.

Nearly 770 000 persons, largely successful farmers, are now aiding the U. S. Department of Agriculture by furnishing information, demonstrating the local usefulness of new methods, testing out theories, experimenting and reporting on conditions in their districts. This army of volunteers receives no pay from the Government. It is estimated that at least one farm out of every twenty is working in some way with the Department of Agriculture. With such a large number of farmers willing to work with the department and the colleges of agriculture, and to test out their recommendations a significant change has taken place from the day when the average farmer was decidedly sceptical about scientific agriculture. The wide use made by the department of agriculture of this large number of practical farmers, the great majority of which are men who farm for a living, indicates clearly how erroneous was the once prevalent idea that the department consisted mainly of agricultural scientists and college-trained men, who were far more at home in their offices than on actual farms.

In a general way the cooperators may be divided into three classes: those who furnish the department with specific information acquired in the course of their regular occupation, those who demonstrate in actual practice the agricultural methods recommended by the department, and those who volunteer to perform with new crops and new methods the experiments which furnish science with the necessary data for practical recommendations. Prominent in the first class are the 158 600 crop correspondents who make possible the Government estimates of crop production and values. Trained experts in the Bureau of Crop Estimates take the reports of these men and by careful comparison and averaging arrive at a knowledge of actual conditions throughout the country which could not be obtained in any other way.

Without such a system the knowledge possessed by any one individual would necessarily be limited, to local conditions, and it is no longer

local but national and world-wide conditions that regulate business. This fact is occasionally overlooked by persons who are surprised to find that a short crop in their own section may be accompanied by low prices and are in consequence inclined to question the accuracy of the Government estimates.

A corresponding service is rendered to the Weather Bureau by its corps of observers. In addition to the reports from sea captains there are 4560 observers who report temperature and rainfall regularly, 2770 who display or disseminate forecasts and warnings and 1300 who report weekly during the crop-growing season upon the effect of weather conditions.

In its researches and investigations the department is also in great measure dependent upon reports from cooperators, 1500 railroad station agents, for example, have been instructed by railroad officials to furnish the office of Markets and Rural Organisation with postcard reports of shipments of perishable crops which are in the market news service of the office. Tariffs and other data are also supplied by the railroads; the cotton exchanges and individual firms send quotations, samples and other information; 400 cold-storage plants report monthly on their holdings of apples; 500 millers, grain dealers, chambers of commerce, etc. furnish the Bureau of Plant Industry with data in connection with the work of grain standardization, and 1200 creameries and cheese factories report to the Bureau of Animal Industry.

These, of course, are only a few instances out of many. They serve to show, however, the ways in which the department keeps in touch with practical business conditions and is assisted by the same men whom it is working to assist.

In the second class of cooperators are the thousands of farmers who, under the supervision of county agents and specialists from the departments and the agricultural colleges, are working out on their own farms the methods recommended by scientific agriculture; the boys and girls of the pig, poultry, corn, and canning clubs who are demonstrating the neglected possibilities of profit in these fields; the women who have adopted for their own benefit and as a means of instructing their neighbours in improved house keeping; the many thousands of members of farm bureaus, county associations and community clubs; nearly 10 000 leaders in club work for community welfare, and the State officials who aid in extension work, in the distribution of animal serums and vaccine and in other ways.

This demonstration work is of the utmost importance in the spread of sound agriculture.

It is almost impossible to name the many forms in which it is being carried on, but one instance of its effect in Alabama is illuminating. A few years ago crimson clover was an unknown crop in that State. The department decided after considerable study that it was one of the most suitable leguminosae for the section and determined to introduce it. Ten farmers each in 10 counties agreed to plant 1 acre as an experiment. Two years later there were 250 000 acres in crimson clover in Alabama.



Another important demonstration in progress at the present time is concerned with cultural methods for sugar beets. In this 1000 farmers are taking part. Another thousand in the arid areas of the Great Plains are planting trees to make shelter belts as recommended by the department. In the cotton belt 80 farmers are demonstrating the advantages of superior varieties and improved cultural methods, and 50 in South Carolina and Alabama are showing how to breed wilt-resistant cotton and are producing for sale seed of varieties developed by the department.

The third way in which farmers are actively cooperating with the department is in the conduct of experiments. These are as varied as the demonstrations.

More than 11 000 are growing the plants which the department introduces from foreign countries. Sixty farmers are now furnishing the land and labour for experiments in corn improvement and 30 are aiding the tobacco work of the department in the same way.

Seed corn furnished by the department is being tested by 600 farmers who, to a certain extent, are also demonstrating the varieties they test.

There is no doubt that practical farmers and business men who devote their time to the department undertakings believe them vital to their own affairs.

## CROPS AND CULTIVATION.

- 5 - **Weather Forecasting and Mountain Stations.** — FERGUSSON S. P., in *The University of Nevada Agricultural Experiment Station Reno, Bulletin No. 83*, pp. 4-30. Carson City, Nevada 1915.

The writer discusses the advantages to be obtained, in regard to weather forecasting, from the comparative statistics furnished by stations situated at the foot and summits of mountains. Observations have been made at Mt. Rose (3292 m.) and at Fallon, situated 97 km. to the East of Mt. Rose in the Carson Luik Valley, at an altitude of 1208 m. The most important results are appended. They are also confirmed by those from other mountain stations.

1) On Mt. Rose, during the period 1911-1914, 32 cases of abnormal and rapid fall of temperature were observed; these were accompanied at the Fallon Station by: a) in 15 cases, an absolute fall simultaneous with the above; b) in 7 cases, a slight rise of temperature; c) in 10 cases, a corresponding fall in temperature, occurring not simultaneously but in the course of the following 48 hours.

The most conclusive results were obtained at Mt. Royal (244 m), Canada, where the thermometer was used in conjunction with that of the station in the plain, viz: the observatory of the University of Montreal.

a) When the temperature at the upper station remains invariably higher than that at the lower station, the weather tends to remain stable, or to become warm;

b) on the other hand, the occurrence of lower temperatures on the mountain tops is to be regarded as an indication of the early arrival of a cold wave in the plain (cf. case c, Mt Rose).

2) When the falls in temperature at foot and summit are simultaneous a cyclone or an anticyclone may be expected over the region concerned.

3) The movements of the atmosphere in general are strongly influenced by the features of the mountain relief between the highest and most isolated peaks. The data collected on the mountain top by no means correspond with those obtained at the same average level over the plain by means of kites and observation balloons.

4) The comparison of data obtained at the foot and summit of mountains has clearly demonstrated the value of this type of research in establishing the effect of topography on the behaviour of the weather. The local study of optical atmospheric phenomena and a knowledge of local topographical relationships as a function of the distribution of meteorological factors are of considerable value as a means of increasing the utility of daily weather bulletins and maps.

- 6 - **The Presence of  $\alpha$  Crotonic Acid in a Soil in the United States.** — WALTERS E. H. and WISE LOUIS E., in *Journal of Agricultural Research*, Vol. VI, No. 25, pp. 1043-1045, 1 Plate. Washington D. C., September 18th 1916.

From a sample of fine sandy loam taken from a sterile spot in a field near Marshall, Texas, United States, DR E. C. SHOREY isolated in 1915, an unsaturated organic acid. In a subsequent examination of the same soil by the writers, this compound was again isolated, and its identity with  $\alpha$ -crotonic acid established. The infertile spots above mentioned are devoid of all vegetation and their area is gradually increasing. The subsoil is a stiff clay of a red colour. The soil is deficient in lime, or other basic material, and is very poorly drained. It has also been found to have a high reducing power and a rather low oxidising power; it therefore seems to present optimum conditions for the formation and accumulation of organic acids. 94 mg. of  $\alpha$ -crotonic acid were obtained from 50 pounds of soil. Hitherto the occurrence in nature of crotonic acid has not been firmly established, and its formation in soils is very difficult to explain. It may perhaps be formed during the destruction of cellulose from  $\beta$ -hydroxy-acids of the aliphatic series, or by the hydrolysis of allyl cyanide, which is found in the essential oils from certain plants, such as mustard.

- 7 - **The Influence of the Lime : Magnesia Ratio in the Soil on the Yield in Seed of Sugar beets.** — See No. 38 of this *Bulletin*.

- 8 - **The Washing Out of Nitrates from Arable Soil at the Rothamsted Agricultural Station (England), During the Winter 1915-1916.** — RUSSELL E. J. and APPELYARD A., in *The Journal of the Board of Agriculture*, Vol. XXII, No. 1, pp. 22-27, 2 diagrams. London, April 1916.

The winter 1915-1916 was much wetter than usual at Rothamsted, especially during December and February. This is shown by the following figures obtained there.



TABLE I — *Rainfall and Percolation during the winter 1915-1916 compared with the averages for the 62 years 1853-1914.*

Month	Rainfall in inches		Percolation in inches (1)	
	1915-16	Average 1853-1914	1915-16	Average 1853-1914
September . . . . .	2.49	2.34	0.83	0.86
October . . . . .	2.60	3.17	1.45	1.83
November . . . . .	2.38	2.60	1.93	2.10
December . . . . .	5.56	2.53	5.32	2.02
January . . . . .	2.24	2.33	1.83	1.79
February . . . . .	3.97	1.82	3.39	1.39
Total for 6 months . . .	19.24	14.79	14.76	9.97

(1) Percolation through 20 inch gauge.

It is well known that, in washing through the soil, water carries with it a considerable amount of soluble material and produces 2 effects: 1) the deflocculation of the clay: 2) the removal of the nitrates.

At Rothamsted, the loss of nitrates was least on heavy land and greater on good land and on light land. It attained the maximum on land that had been well manured the previous year and either fallowed, or bastard fallowed, these being the conditions under which the maximum amount of nitrate production goes on in the soil. The writers illustrate, by means of a diagram, the changes that occurred in the amount of nitrate on the Broadbalk dunged plots, one of which was fallowed, and the other cropped.

On the fallow plot, it was observed that from April to September 1915, nitrate was steadily accumulating in the top 18 in. excepting only in early May and early August, when percolation was high. By the middle of September, the top 18 in. of soil contained 170 lb. of nitrogen per acre in the form of nitrate, this being equivalent to nearly 10 cwt. of nitrate of soda. Then the accumulation ceased and the losses began. Throughout September and October they were not very great, but in November and December they were disastrous, so that by February the nitric nitrogen in the soil had been reduced to 50 lb., equivalent to only 320 lb. of nitrate of soda. The result of the winter rainfall, therefore, was a loss to this plot of 120 lb. of nitrogen, equal to 7 cwt of nitrate of soda per acre. The cropped plot was never able to accumulate nitrate to anything like the extent of the fallow plot, partly because the microorganisms made less, and partly because the crop took up much of what was there. No more than 90 lbs of nitric nitrogen per acre was ever shown in the analysis, but the fact that this amount was maintained in spite of the October and November percolation indicates that more had been produced, but was washed away. Even as it was a loss of 40 lb. of nitrogen is recorded, equivalent to more than 250 lb. of nitrate of soda.

The losses from various plots are given in Table II.

TABLE II. — *Nitrogen as nitrate; lb. per acre in top layer of soil of 18 inches.*

Experiment Plots	Autumn 1915	February 1919	Loss from Oct. to Febr.
Broadbalk, dunged, fallow . . . . .	175	50	125
"      "      dunged cropped (wheat) . . . . .	90	47	43
Great Harpenden Field, cropped (wheat) . . . . .	70	40	30
Broadbalk, unmanured, fallow . . . . .	68	40	28
"      "      "      cropped (wheat) . . . . .	51	46	5
Hoos, unmanured, fallow . . . . .	34	9	25
"      "      unmanured cropped (wheat) . . . . .	32	12	20

Harpenden field represents fairly closely the ordinary case of land which is fairly but not unusually well done. It grew potatoes in 1914, when it had 12 loads of dung and chemical fertilisers, then followed wheat without manure. This did not exhaust the stock of quickly-available nitrogen, for there was still 70 lb. per acre in the autumn of 1915. During the winter, however, 30 lbs. per acre was lost.

The Hoos field wheat crops have had no manure for over 50 years. They are therefore in a low condition and the crop is always small, averaging only 16 bushels. Yet even its small stock of nitric nitrogen, which would have sufficed for 22 bush. the next season, was largely dissipated by the winter rain.

Taking the results as a whole, they show that the fields which had not been unusually well manured lost some 30 lb. of nitric nitrogen per acre, equivalent to 190 lb. of nitrate of soda, as a result of the winter rainfall, while the plots that had been heavily manured lost considerably more.

The obvious lesson is, that land which has been got into a good state in autumn should at once be sown, either with the crop it is intended to carry, or with a catch crop, such as mustard (*Sinapis alba*), which can be fed to sheep or else ploughed in.

In order to remedy in spring the condition of this washed out soil, it is necessary: 1) to reflocculate the clay; 2) to make good the loss of nitric nitrogen. The first is effected by the application of lime, or soot to the soil, while the loss of nitrogen can be remedied by a dressing of quick acting nitrogenous manure, or of soot. That the latter substance serves both purposes has long since been recognised by the practical man.

9 - **Carbon and Nitrogen Changes in Soil Treated with Lime, Ammonium Sulphate and Sodium Nitrate.** — POTTER R. S. and SNYDER R. S., (Laboratory of Soil Chemistry of the Iowa State Experiment Station) in *Soil Science*, Vol. I, No. 1, pp. 76-94, VII plates, 2 fig. New Brunswick N. J. 1916.

The importance of organic matter in the soil is universally recognised, but the rapidity with which this decomposes and is lost is hardly appreciated. SWANSON has recently pointed out that 150 tons of vegetation were necessary to produce the organic matter in the surface of some typical Kansas soils, and that one ton was the least amount of organic



matter which must be returned to these soils, in addition to the stubble and corn stalks. Therefore, studies on the rate of decomposition of the organic matter in the soil are of interest.

This is the subject of the investigations carried on by the writers, who have made a series of experiments with soil treated with various organic and inorganic fertilisers, and have determined the loss of nitrogen as ammonia, the evolution of carbon dioxide, and the changes in the ammonia, nitrate, nitrogen and carbonate content of the soil. For the present, they confine themselves to communicating the results obtained with lime, ammonium sulphate and sodium nitrate.

The Miami silt loam used for these experiments contained 1.35 per cent. of carbon and 0.1137 per cent. of nitrogen; its lime requirement, according to the VEITCH method, is 600 pounds per acre. The carbon dioxide evolved and the ammonia liberated from the soil, whether treated or not, were determined by passing a current of air over soil in pots covered by bell jars, and then through standard acid and potassium hydroxide. A considerable amount of carbon dioxide was given off during the first two days that the soil was treated with sodium nitrate; more was eliminated when ammonium sulphate was used, and a still larger amount when the soil was treated with carbonate of lime, either alone, or mixed with nitrogenous fertilisers. Afterwards, the evolution greatly decreased, the amount, however, being always slightly largest in the pots treated with carbonate of lime. The origin of the carbon dioxide is not yet clear, for in one case the addition of carbonate of lime decreased the amount of carbon dioxide given off by the organic matter, while in another case it increased the amount. The loss of ammonia was about 0.3 pounds per acre in 12 weeks; it was about 10 times as great from soils treated with both lime and ammonium sulphate, but it is not at all probable that this rate would be kept up for a very long period after the application of the sulphate.

In a general way, limed soils lose less nitrogen than unlimed soils.

Further researches are necessary before the results obtained can be applied to field conditions.

A bibliography of 22 publications quoted in the text is appended to the article.

- 10 - **Researches on the Equilibrium between the Nitrogen and Carbon in the Soil.** — FELBER PAUL, in *Mitteilungen der landw. Lehrkanzeln der KK. Hochschule für Bodenkultur in Wien*. Vol. 3, No. 1, pp. 23-54. Vienna, 1916.

KASERER showed experimentally that for every soil there is a certain state of equilibrium between the nitrogen and carbon (proportion of humus) which is influenced by the chemical composition and reaction of the soil, the water and the conditions of temperature.

In order to prove this theory in relation to cultivated soils, the Author undertook a series of experiments with 13 soils, all of different geological formation and composition, such as: clay and sandy clay soils; sandy poor in humus; black sandy rich in humus; soils rich in lime; poor in lime. The soils mostly came from Szenics (comitat of Ventra, Hungary), where there is great variety of soil.

To obtain the samples, ditches were dug (in summer) with vertical walls, about 3 ft. deep and 3 ft. wide, then a sample of both surface and sub-soil was cut out with a spade. Each 10 lb. sample (about) was carefully crumbled, mixed, air-dried under protection from dust and then analysed.

The total nitrogen was determined by the KJELDAHL-JODBLAUR method and the organic matter by the chromic acid method.

In arable soil, 10 to 12 units of nitrogen were found for every 100 of carbon. In soils very rich in humus, 10 units were found, in soils poor in humus, on the contrary, 13 to 15 units of nitrogen per 100 of carbon. These proportions varied more in the sub-soil: between 11 and 14. The amounts of nitrogen and carbon decrease with the depth, the carbon more rapidly. The amount of alkaline earths in the soil has an influence in the sense that it promotes the accumulation of humus, without influencing the relative proportion of nitrogen. The relations between carbon and nitrogen are fairly constant for different soils, and it seems that they may allow of a method being elaborated to determine approximately the humus content of the soil from its nitrogen content.

The soils were afterwards modified by adding various substances, and submitting them to bacterial action. The proportions between nitrogen and carbon were compared before and after the modifications, in order to find if the relation is re-established after some time, when it has been modified by these additions. To try this, test pots were filled with 11 lbs. of earth and the following substances added at the rate of 7 parts per 100 of earth.

- 1) Earth + without addition.
- 2) Earth + lime.
- 3) Earth + soya meal.
- 4) Earth + soya meal + lime.
- 4) Earth + Rye straw meal.
- 6) Earth + Rye straw meal + lime.

In the earth without additions, the bacterial activity caused a loss in organic matter as well as in nitrogen. This imitation of fallow did not have a favourable effect on the economy of the soil nitrogen. The addition of soya meal also caused a loss of carbon and nitrogen. Part of the nitrogen of the soya seeds nitrifies easily. — The addition of straw caused less loss of nitrogen than the soya. — With lime added, the decomposition of the organic matter became more intense, but ammonia did not appear to be lost. As for nitrification, denitrification and nitrogen fixation, they were in no way influenced by the lime.

In a subsequent experiment, it was attempted to ascertain if on digesting the earth in water at a high temperature, it behaves differently than when in culture pots, and in what way. 60 cc. flasks were used and filled with 10 grms. of earth and 10 cc. of water, the whole being maintained at a temperature of 30° C. for 3 days in an incubator; into some of the flasks calcium carbonate was added. At the end of a month the water was absorbed, cracks appeared in the earth and traces of mould appeared.



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Analysis showed that the carbon had diminished considerably (up to 20 %) in amount, while the loss of nitrogen was small. The relation between carbon and nitrogen was thus displaced to the benefit of the nitrogen. It was concluded that the earth behaves differently in an incubator than in the open air, as the higher temperature induces greater bacterial activity. No conclusions can be drawn as to the effect of the lime on the decomposition of the organic matter. A second experiment yielded similar results.

To ascertain how the elimination of carbon and nitrogen from a combination rich in those elements is carried out, Erlenmeyer flasks containing 10 grms of each soil together with 50 cc. of a soil-infusion and 0.5 grms of soya meal (containing 7.35 % N. and 40.4 % C) were placed in an incubator ; lime was added to two samples of earth.

After 40 to 45 days, there was a considerable elimination of carbon and nitrogen ; but the relation between the two was much the same at the end of the experiment as at the beginning. All the same, the relation differed from that of untreated earth, which latter had changed during the experiment in favour of the nitrogen. In one case the lime prevented the elimination ; in the other case it had no appreciable influence.

To ascertain if, at the optimum temperature of *Azotobacter*, nitrogen fixation can be produced by adding energy in the form of straw meal, a series of soil samples were mixed with this meal and afterwards placed in an incubator. After 14 days, nitrogen was found to be fixed in a clay-sandy soil and in a sandy soil at the rate of 6 and 4 mg. respectively per 100 grms of soil. For each unit of nitrogen fixed, 73 units of carbon were consumed in sandy soil and 37 units in clay-sandy soil, numbers corresponding respectively to 174 and 86 units of straw. In another clay-sandy soil, the amount of nitrogen fixed even reached 46 mg. per 100 grms of soil. It did not result from the reduction of nitrates.

In order to find how saltpetre behaves in the presence of organic matter in the soil, 10 grm samples of soil were taken and to them were added saltpetre alone, and also saltpetre and straw meal. The nitrogen estimation was made by the DEWADRA method. It was found that in the sample to which straw meal had been added, the saltpetre had completely disappeared. In the tests without straw, there had been elimination of carbon, but the saltpetre had remained intact.

In another experiment, the straw was replaced by an easily assimilable carbon compound *i. e.* dextrose. The saltpetre also disappeared in this case although the bacteria had a sufficient source of energy available.

The results of the experiments with saltpetre seem at first sight to contradict the theory of equilibrium between carbon and nitrogen. In fact in the experiments without additions, the saltpetre remained intact, while it was partly denitrified by the addition of straw and dextrose. But as denitrification requires a source of energy that was wanting in the soils without additions, the saltpetre in these tests remained intact, while in the case of added straw and dextrose, there were no available carbon com-

tions this bacterial activity is shown rather by crop yields and, in the pond, rather by the enrichment of the soil in nitrogen.

8) The methods used to determine the nitrogen fixing power of field soil can also be employed for pond soil provided they are complemented by the determination of the fixing power in water possessed by nitrogen-fixing bacteria living in symbiosis with green aquatic plants.

13 - **The International Movement of Fertilisers and Chemical Products Useful to Agriculture (Half-yearly Review)** (1). — *Bulletin of Agricultural and Commercial Statistics* Year 7, No. 9, pp. 615-688. International Institute of Agriculture, Bureau of Statistics, Rome, September 1916.

MANURES  
AND  
MANURING

This review contains a considerable number figures of official origin or from trustworthy private sources. It deals with the principal fertilisers (*Phosphatic, potassic, nitrogenous*) and chemical products employed in agriculture.

All weights are given in metric tons of 1000 kg = 2204.6 lbs.

The most important information is summarised below.

I. — *World's Production*. — Because of present conditions, it is impossible to obtain figures for the production of *natural phosphates* in 1916. The only figures given are those relating to the shipments. Speaking broadly, the latter have not decreased so much as for lack of labour as for the increase of the cost of carriage. The following table summarises the principal figures given in this review.

*Production of Natural Phosphates (in metric tons).*

	1916 (1st half year)	1915	1914	1913
United States . . . . .	326	1 865	2 778	3 161
Algeria . . . . .	163	165	226	461
Egypt . . . . .	13	83	72	104
Tunis . . . . .	224	1 389	1 444	2 285

As regards *calcium superphosphate*, the decrease of in supplies of natural phosphates and the ever increasing demand for sulphuric acid for war purposes in the belligerent countries, has seemingly decreased the supplies of superphosphates, though no figures are available for many regions. For 1916 in France there is expected to be a production of 350 000 tons against 600 000 in 1915, 1600 000 in 1914 and 1920 000 in 1913. Thus there is a reduction of more than 70 % in the figure for 1915 as compared with the normal as 1913.

In Portugal 120 000 tons are forecasted for the current year, and in Australia 30 000. In the latter country the figure has diminished from 38 000 tons in a normal year.

The production of *potash salts* is known for 1914 which is summarised and compared with 1913 and 1912. All the products show a considerable diminution.

(1) See B. January 1916, No. 13.



Potash salts	1914	1913	1912
		metric tons	
Total of crude salts . . . . .	8 171	11 608	11 070
including { Carnallite, Kieserite . . . . .	3 651	5 302	5 282
Hartsalz, Kainit and Sylvinit . . . . .	4 521	6 305	5 788
Total amount used by agriculture . . . . .	2 580	3 567	3 312
including Hartsalz, Kainit and Sylvinit . . . . .	2 541	3 508	3 250
Production of concentrated salts . . . . .			
manures at 20,30, 40 % . . . . .	855	906	723
80 % potassium chloride] . . . . .	363	484	471
90 %     "     sulphate . . . . .	76	111	116

The output and trade in *nitrate of soda* showed a large decrease in the last half of 1914 and the first half of 1915, while the second half of 1915 showed a largely increased consumption of nitrate for industrial purposes.

This state has continued during the last six months, and the augmentation has brought the figures into closer relation with the normal than was the case earlier in the war. Production for the first six months of 1916 is nearly threefold (1 488 792 metric tons) as compared with the same period in 1915 (587 876 metric tons).

Shipments have also been much larger. France in six months of 1916 has taken 120 506 metric tons while in all 1915 the purchases were only 83 202 tons. The same thing has occurred in the United States, shipments to that country having attained in the first half of 1916 more than three-fourths of the total of 1915. For arrivals in Europe and Egypt, the six months of 1916 show a total of 776 169 metric tons, as compared with 410 301 tons up to June 1915, and 891 126 tons in the whole of last year. Stocks at Chilean ports were 919 102 metric tons on 30th June 1916, nearly 100 000 tons more than those of the same date in 1915.

The output and commerce in Chilean nitrate of soda during the first half year of 1916 and the 3 years 1915, 1914 and 1913 are summarised in a table.

Nitrate of soda	1916 1st half year	1915	1914	1913
		in 1000's of metric tons		
Production . . . . .	1 489	1 764	2 464	2 774
Export . . . . .	1 356	2 031	1 848	2 740
Consignments for consumption . . . . .	(a) 730	(a) 861	(a) 2 249	2 557
Visible Stocks . . . . .	to June 30	to December 31		
	(b) 919	(a) 991	(a) 1 190	1 772

(a) Partial Figures only available. — (b) Chilean coast only.

With regard to *sulphate of ammonia*, the amount left for agriculture after the beginning of the European war has been steadily diminishing on account of the needs of industries. The table gives the information published in the review.

Sulphate of Ammonia	1916 (forecast)	1915	1914	1913
	in 1000's of metric tons			
Germany (sales) . . . . .	—	—	406	435
Spain . . . . .	16	15	15	15
France . . . . .	25	42	—	74
Great Britain . . . . .	33	16	17	14
Russia . . . . .	—	423	426	433
Sweden . . . . .	1	1	2	1
United States . . . . .	—	200	166	177
Australia . . . . .	7	7	6	5

As regards the synthetic nitrogenous fertilisers such as calcium cyanamide and calcium nitrate, the manufacturers have greatly increased their productive capacity either by enlarging existing works or building new ones. But the amounts of these manures available for agriculture has not increased proportionately. The manures are more and more restricted and in certain countries the whole output is reserved for the industrial needs of the state.

The inactivity in the European trade in *sulphur* has continued increasingly for the last six months on account of the difficulty of obtaining freight space and in the great rise in the price of coal. In the United States the production of sulphur greatly increased during 1915.

*Copper sulphate* has been produced in greater quantity in France, in slightly less quantity in Great Britain and Ireland, while the output remained stationary in Italy as shown in the following table.

Copper sulphate	1916 (Forecast)	1915	1914	1913
	in 1000's of metric tons			
France . . . . .	25	10	21	26
Great Britain . . . . .	60	66	69	77
Italy . . . . .	48	50	31	44
United States . . . . .	—	19	14	25

II. — *International Trade.* — International trade is practically at a standstill for nearly all the fertilisers and chemical products in Europe and there is hardly any trade in many products for certain countries like Holland, Sweden and Russia. On the other hand the trade in nitrate of soda between Europe and the United States has considerably increased.

III. — *Wholesale prices.* During the second six months of 1915 all the chemical manures and products had continually increased in price, sometimes very considerably. The increase is maintained but at a slightly lower level. It is probably only phosphates that have not varied in price. Copper sulphate has gone down in price in the United States.

The figures for the principal products are as follows :



	Average for Jan. 1916	Average for June 1916	Average for 1st 6 months 1916	Average for August 1916
in gold francs per metric quintal of 100 kg.				
<i>Nitrate of Soda</i>				
Valencia (Spain) . . .	45.29	49.83	46.95	49.21
French Atlantic ports.	37.54	40.02	38.18	40.79
Genoa . . . . .	43.94	41.05	40.76	41.28
Liverpool . . . . .	39.96	45.60	43.76	46.03
New-York . . . . .	39.73	36.18	30.20	—
<i>Sulphate of Ammonia</i>				
Valencia (Spain) . . .	50.72	58.48	54.19	55.37
Paris . . . . .	48.49	50.15	49.44	51.77
Genoa . . . . .	51.40	50.40	51.46	50.49
Hull . . . . .	43.71	41.99	42.18	44.38
New-York . . . . .	46.27	41.73	44.11	—
<i>Copper sulphate</i>				
Valencia (Spain) . . .	166.13	205.81	198.73	203.29
French Atlantic ports.	108.20	141.05	117.51	137.82
London . . . . .	14.26	130.84	124.14	124.22
Genoa . . . . .	147.50	150.50	146.40	139.50
New-York . . . . .	227.49	151.72	210.92	—

The *Review* concludes with a bibliography of 566 titles taken from the world literature published during the first six months of 1916.

14 - *The Utilisation of Sewage-water in Italy.* — AITA A., in *L'Italia agricola*, Year 53, No. 11, pp. 499-502. Piacenza, November 15, 1915.

With the exception of Milan, which has for a long time used its sewage-water for irrigation, nearly all the towns in Italy turn their sewage-water into the watercourses or into the sea. Yet, a certain amount is collected both in large and small towns by companies and taken to large special reservoirs. This night-soil is richer in fertilising material than the sewage water turned into streams, as it is much less dilute. Table I shows the composition of several of them. Table II shows the relation between the 3 forms of nitrogen: organic, volatile ammonia and fixed ammonia in the night soil; it gives the results of analyses of samples taken from the reservoir at Cremona. After settling in the reservoirs, the liquid night-soil separates into a liquid upper layer containing all the ammoniacal nitrogen, and a lower layer forming a solid deposit of mud with 80 to 90 per cent. of water.

From the upper layer, assuming an average of 3‰ of ammoniacal nitrogen, 15 kg. of ammonium sulphate per cubic metre worth 4.50 fr. (at a normal price of 30 fr. per 100 kg.) would be obtained. The distillation of the ammonia presents no technical difficulty, but, in Italy, it is hindered by the high cost of fuel. The author estimates that 20 kg of coal are necessary to distil 1 cubic metre of the upper liquid and gives the cost according to normal prices.

TABLE I. — *Composition in parts per 1000 of several Italian sewage waters.*

Total N.			Total P <sub>2</sub> O <sub>5</sub>			Potash			Towns.	Analysts
Min.	Max.	Av.	Min.	Max.	Av.	Min.	Max.	Av.		
2.24	8.54	4.20	0.10	2.87	0.76	1.67	2.09	1.88	Pisa	TARUGI and BERTINI (18 analyses).
1.98	3.90	3.30	0.38	0.51	0.43	0.82	1.02	0.94	Pisa	MASSONI (5 analyses).
—	—	3.00	—	—	0.35	—	—	0.25	Milan	MENOZZI and GRUNER.
—	—	2.78	—	—	0.20	—	—	0.28	Florence	PASSERINI.
2.32	4.47	3.13	—	—	—	—	—	—	Florence	PASSERINI (7 analyses).
—	—	4.28	—	—	1.79	—	—	4.26	Scandicci Alto	PASSERINI.
1.88	3.68	2.82	—	—	—	—	—	—	" "	PASSERINI (6 analyses).
3.27	4.51	3.91	0.29	0.37	0.43	0.20	1.49	1.05	Cremona	ATTA (3 analyses).

TABLE II — *Nitrogen (parts per 1000) in Cremona night soil.*

	Total N.	Organic Nitrogen	Ammoniacal nitrogen		
			total	volatile	fixed
Decanted liquid . . . . .	4.518	0.168	4.350	—	—
" " . . . . .	3.680	0.230	3.450	—	—
Undecanted liquid . . . . .	3.988	0.728	3.260	1.245	2.017
" " . . . . .	4.144	0.614	3.530	1.330	2.200

TABLE III. — *Cost of distilling 1 cubic metre of the separated upper liquid.*

Fuel	20 kg at 0.05 fr per kg. . . . .	1.00 fr
Sulphuric acid	12 kg at 0.045 " " " . . . . .	0.55
Lime	5 kg at 0.03 " " " . . . . .	0.15
Labour . . . . .		0.50
Total cost . . . . .		2.20 fr

There is thus sufficient margin for paying ample expenses and depreciation. According to the author, it would be worth while undertaking the manufacture of ammonium sulphate in Italy with the supernatant liquid from the settled night soil, especially in the smaller towns using small apparatus capable of dealing with 10 to 15 cubic metres a day.



Recently the possibility has been suggested of extracting the ammonia by the prolonged effect of a current of air passing through the liquid, but some large scale experiments by the writer have shown that the method is not practicable, as the ammonia obtained is not more than 20 per cent. of the total quantity present.

Finally the Author briefly describes the treatment of the solid residues as carried out in England and Germany in order to extract the fatty matter forming from 3 to 26 per cent. of the dry sludge (16.7 % as an average according to Dr. BECHHOLD).

**15 - A Potassic Manure obtained from Orthoclase Felspar, in Canada.** — SHUTT F. T., in *Experimental Farms, Report of the Division of Chemistry, Year ending March 31, 1915*, pp. 128-129. Ottawa, 1916.

Analysis of a product obtained by heating orthoclase felspar in a furnace with limestone and iron ore, the whole reduced to fine powder. Solubility determinations have the following results:

Solvent	Soluble potash as % of the product		
Water . . . . .	traces	—	0.48
1 % citric acid. O . . . . .	3.16	— 3.34 —	3.15
Hydrochloric acid, density 1.115 .		4.40 —	4.43
Concentrated Hydrochloric acid .			5.41

With these results, it was concluded that 5.41 % of the potash could, in time, become soluble, while 16.34 % will be more or less immediately soluble.

Potash Felspar or Orthoclase exists in considerable deposits in many regions of Canada. It contains from 10 to 12 % of potash, and if this potash was rendered available from the agricultural point of view and at a reasonable price, a useful industry could be established, considering the actual price of potash salts.

**16 - The Use of Seaweed for the Production of Potassic Manures.** — See No. 91 of this *Bulletin*.

**17 - New Experiments on the Action of Sulphur on Crop Production (1).** — PFEIFFER, in *Fühlings landwirtschaftliche Zeitung*, 65th Year, No. 7-8, pp. 193-207. Stuttgart, 1916.

It is recognised that sulphur, on being added to organic nitrogen compounds, causes abundant decomposition with formation of ammonia, and an increase of yield results. This action of sulphur is particularly marked when associated with farmyard manure or dried blood.

To determine the effect of sulphur, experiments were undertaken on a field rich in organic nitrogen compounds, but not having been manured for a long time and having grown beets for 3 successive years without receiving any manure at all. From the standpoint of physical constitution the field showed great differences, which were clearly shown by the results of preceding crops, as well as by the sulphur experiments. The

(1) Conclusion of experiments of the same author (action of sulphur on beets) described in *B.* 1915, No 798. (Ed.)

field was divided into 24 plots, each of about 11 sq. yds. area, and receiving the following manures.

- 6 plots : Farmyard manure only.  
 6 plots :       "       "       + sulphur.  
 6 plots : Dried blood only.  
 6 plots :       "       "       + sulphur.

The farm yard manure was applied at the rate of about 8 tons per acre and the sulphur at 357 lbs per acre.

Both farmyard manure and dried blood were intimately mixed with the sulphur. Each plot received an additional manuring of 1 lb basic slag and 1 lb of kainit.

*Fan barley* was sown on the plots. At the beginning of earing the plants on the plots having had dried blood and sulphur seemed the best developed.

The appended Table gives the average results for each series of 6 plots.

Manure	Grain		-Straw		Grain and straw	
	Dry Matter	Nitrogen	Dry Matter	Nitrogen	Dry Matter	Nitrogen
	grms	grms	grms	grms	grms	grms
Farm yard manure only . .	3 278 ± 111	73.3 ± 1.5	3 390 ± 63	23.5 ± 1.7	6 668 ± 144	96.8 ± 2.3
F Y M + sulphur. . . . .	2 967 ± 177	63.8 ± 3.1	3 087 ± 172	18.8 ± 0.4	6 054 ± 347	82.6 ± 3.4
Dried blood only	2 997 ± 149	68.4 ± 3.4	3 032 ± 104	20.1 ± 0.4	6 028 ± 247	88.5 ± 3.8
Dried Blood + sulphur . . .	3 191 ± 115	71.5 ± 2.9	3 330 ± 106	23.1 ± 0.9	6 521 ± 212	94.6 ± 3.5

The fact that the yields of grain are very high as compared with straw is referable to the drought during growth.

The total yield, however, is high for it reaches 40.01 cwt of grain and 39 cwt of straw per acre.

Sulphur + farmyard manure caused a decreased yield in grain and straw as well as a decreased nitrogen content of the crop. All the differences are within the limits of probable variations and should therefore be checked by controls. Sulphur + dried blood acted satisfactorily, but the excess of yield is not very great.

The Author concludes that application of sulphur, either with farmyard manure, or dried blood, has produced no particular increase in the crop.

To ascertain if the experimental results agree satisfactorily with the law of probable error of GAUSS, they were compared with the yields of the



same plots under beet in 1914. In spite of variations caused by physical differences in the soil of the experimental field, the results on the whole agree very well.

The two conditions of the law of GAUSS were almost entirely fulfilled. The results of the experiment with sulphur are less suitable for an examination of this kind, but there was, however, a satisfactory agreement.

The Author is of opinion that the calculation of the probable variations is an excellent method for forming an objective opinion on the results of experiments.

18 - **Seeds and Plants Introduced into the United States by the Bureau of Plant Industry of the Department of Agriculture during the Second Half of 1913** (1). — I. U. S. Department of Agriculture, Bureau of Plant Industry, *Inventory of Seeds and Plants Imported by the Office of Foreign Seed and Plant Introduction During the Period from July 1 to September 30, 1913*, No. 36, 74 pages + 6 Plates Washington, December 23, 1915. — II. *Idem*. *Inventory No. 37* (Period from October 1 to December 31, 1913) 95 pp. 6 Plates, Washington, March 25, 1916.

I. — The first list, Nos. 35 667 to 36 258, includes the seeds and plants introduced into the United States from July 1 to September 30, 1913, of which the most important are as follows :

#### CEREALS.

*Avena sativa*. — No. 36 196 : Local variety originally sent from the Experiment Station at Tulun, Irkutsk, Siberia.

*Hordeum vulgare*. — No. 36 005 : Barley from the southern extremity of Lake Titicaca (Bolivia) at an altitude of from 12 500 ft. to 13 000 ft.

*Holcus Sorghum*. — Nos 36 075 to 36 077 : three varieties of sorghum from San Tun Ying, Chihli Province, China. Grain half white and half red, large, white and glutinous respectively—used for human consumption.

*Secale cereale*. — No. 36 055 : variety of rye from Omsk, Siberia.

*Triticum spp.* — Nos. 36 142 and 36 143 : Wheats from Panguipulli and Llifén, Chile, respectively. Chilean wheat brings a higher price in the European market than that of Argentina. Several varieties may often be found in the same field, some of which may prove of interest.

*Triticum aestivum* (= *T. vulgare*). — Nos. 35 950 and 35 981, from Quilan, Chiloe Island, Chile. No. 35 952, from Osorno, Chile. No. 36 144, from Llifén, Chile.

No. 36 004, wheat from the southern extremity of Lake Titicaca (Bolivia) at from 12 500 ft. to 13 000 ft.

*Triticum durum*. — No. 36 003 "Chernouska" spring wheat from Semipalatinsk, Siberia.

*Zea mays*. — No. 35 998, variety of maize from Castro, Chile, the only one which can ripen in this cold, wet region. May be capable of being acclimatised in Northern countries.

Nos. 36 185 to 36 191 ; 36 195 ; 36 197 ; 36 295 to 36 253 ; varieties of maize with grain of different colours, and intermediate shades : white — grey — yellow — pink — red — brown, etc. with, or without spots or stripes - from Arequipa and Cuzco, Peru.

Nos. 36 192 to 36 194 ; 36 198 to 36 205 : varieties of maize having respectively grain of the following colours : white — grey — yellow — light strawberry — black — from Oruro and La Paz, Bolivia.

LEGUMINOSAE.

- Phaseolus angularis*. — Nos. 36 080; 36 084; 36 085; varieties of this bean from San Tun Ying and Tientsin, China. Beans much appreciated for human consumption, young sprouts form excellent winter vegetable.
- Phaseolus vulgaris*. — Nos. 35 984 and 35 985; 35 993; 36 178 to 36 182, varieties of this bean from Chile.
- Soja max.* — No. 36 079: An early variety from San Tun Ying, China.  
No. 36 116; a rare variety with beans of an olive colour.
- Vigna sinensis*. — No. 36078: a variety of which the seeds are half white and half reddish, used as a human food; from San Tun Ying, China. No. 36 083: variety with small white seeds with a dark-coloured eye. Used for human food; comes from Tientsin, China.

LEGUMINOSAE FOR GREEN MANURE AND FOR BINDING SOIL.

- Lupinus arboreus*. — No. 35 969: a lupin from near Talchahuano, Chile. On light, rather dry soil, it grows about 4 ft. high and may prove useful as a sand binder.
- Meibomia hirta*. — No. 36 060, from Kyimbila, German East Africa, where it grows up to an altitude of 1 600 m. It can be propagated by rooted cuttings. Does well even on poor soils. Rapidly fertilises soil. Can also be used as a cattle feed. It is suggested that experiments should be made with it as a cover crop in the orchards in Florida.

FORAGE PLANTS.

- Chloris paraguayensis*. — No. 36 255: from Sydney, Australia ("Australian Rhodes Grass"). Average height 4 ft. Stooling abundant. Yields twice the amount of hay yielded by *Chloris Gayana* and is a much softer feed.
- Holcus Sorghum* (= *Sorghum vulgare*). — No. 36074: a very strong, tall sorghum with brown-red seeds, mostly used as cattle food and in spirit manufacture.
- Lathyrus* spp. — Nos. 35 961 to 35 965; 36 105: Vetches from Argentina and Chile. The variety No. 36 105 grows in sandy soil.
- Medicago arabica*. — No. 36 136; Lucerne from Kingsboro, North Carolina.
- Melinis minutiflora*. — No. 36 051; a variety from Angola, Africa.
- Paspalum Bertonii*. — No. 36 165: from Puerto Bertoni, Paraguay, a densely caespitose, perennial grass growing among rocks and sand on the banks of the Parana river.
- Pennisetum purpureum*. — No. 36 103: a tall grass with long spikes ("Elephant Grass") from Salisbury, Southern Rhodesia; grows wild in Guinea and Kamerun, West Africa and from Zanzibar to Mozambique on the East Coast.

STARCH-BEARING PLANTS.

- Ipomoea Batatas*. — Nos. 35 878 and 35 879: sweet potatoes from Lima, Peru.  
No. 36 056: Very vigorous sweet potato from Mount Silinda, South Rhodesia. The tubers are of a good shape and flavour; when boiled, they are red under the skin, but of a rich golden yellow below the surface.
- Solanum* spp. — No. 35 686 and 35 687; wild potatoes collected at Guaqui Mole, Bolivia.  
Nos. 35 899 and 36 093; potatoes from Guaqui and La Paz, Bolivia. The frozen tubers are sold under the name of "papa amarga" (bitter potatoes). No. 36 104: wild potatoes from the island of Conejos, Chili. There are 2 kinds, or perhaps more, of which one grows to a height of over 2 m.
- Solanum columbianum*. — Nos. 36 129 and 36 130: Potatoes with violet flowers, from San José, Costa Rica.



*Solanum muricatum*. — No. 36 048: "Sweet Pepino" from San Salvador, Salvador.

*Solanum tuberosum*. — 164 Nos. from Peru and Bolivia.

*Ullucus tuberosus*. — 12 Nos. coming from different places in Peru and Bolivia.

#### AROMATIC AND MEDICINAL PLANTS.

*Panax quinquefolium*. — No. 36 175: Ginseng from Songdo, Chosen, Korea, which is the most famous centre in the world for its cultivation and preparation. In this place, about 8 000 kg. of red ginseng and nearly 30 000 kg of white was produced in 1913.

#### KITCHEN GARDEN PLANTS.

*Apium* sp. — No. 35 920: a wild celery from Quilan, Chile, where it grows near the sea. It has more or less the same taste as *Apium graveolens*, and can be utilised in the same way.

*Asparagus* sp. — Nos. 35 976 and 35 977: Asparagus from Smyrna, Syria.

*Brassica pekinensis*. — No. 36 054: "Pai-ts'ai" cabbage from Tientsin, China. Nos. 36 113 and 36 114 are large quick-maturing varieties which have a rich flavour and are more easily digested than ordinary cabbages; they emit no offensive odours when being boiled. If covered with soil, after being stored layer on layer in a cellar, No. 36 113 will keep all the winter. No. 36 114 is an autumn cabbage. Both would be valuable additions to the kitchen garden.

*Chenopodium Quinoa*. — No. 35 978, from La Paz, Bolivia, Nos. 36 006 and 36 007 come from the southern extremity of Lake Titicaca (Bolivia) at an altitude of from 12 500 ft. to 13 000 ft.

*Cucumis Melo*. — Nos. 35 933 to 35 942; 35 963: Varieties of melon from Chili. Their shape and dimensions vary, their flesh is white or yellow, and of excellent quality.

*Colocasia* spp. No. 36 010: Colocasias from Queensland, Australia. No. 36 057: from Southern Rhodesia. No. 36 121: from Pekin, China.

*Cucurbita* spp. — Nos. 35 943 and 35 944: squashes from Chile.

*Daucus Carota*. — No. 36 156: Carrot grown by the Indians. Comes from Chili.

*Fragaria chilensis*. — No. 35 953: strawberry with round fruit, grows wild on the sand of the sea shore of Chiloe, Chile.

*Raphanus sativus*. — No. 35 890: good variety of radish, from Tampa, Florida; original seed obtained from Egypt. No. 36 115; a variety of radish from Pekin, China; winter radish with long, green root, recommended for its stomachic properties.

*Vicia faba*. — No. 36 008: broad bean from southern extremity of Lake Titicaca (Bolivia) at altitude of from 12 500 ft. to 13 000 ft.

#### ORNAMENTAL PLANTS.

*Pinus Bungeana*. — No. 35 916: a pine (native of China) from Seoul, Chosen, Korea. The adult trees with their smooth, shining, white bark are very ornamental.

*Prunus triloba*. — 36 112: a plum from Pekin, China. Fine ornamental shrub, flowers early, grows out of doors. Blossoms vary from pale pink to a dark violet-rose. Much cultivated in gardens in China.

#### FRUIT TREES AND SHRUBS.

*Anacolosia luzoniensis*. — No. 35 893: from Cavite, Philippines. A newly discovered fruit. ("galo"). The pulp which is very succulent and surrounds the shell is eaten, and the starchy kernel may be eaten raw, or roasted.

*Artocarpus odoratissima*. — No. 36 256: Bread fruit tree from Lamao, Philippines, with juicier, sweeter and more aromatic fruits than any other bread fruit tree.

- Castanea mollissima*. — No. 35 891 : Chestnut from San Tun Ying, China, cultivated in China for its excellent fruit. Resistant to *Endothia parasitica*.
- Citrus* spp. — Nos. 35 600 and 35 700. Collection of citrus fruits from India, promising well : *Citrus limonia* with round seedless fruits, comes from Cawnpore — the lime "Kaghzi" (*C. aurantifolia*) with fruits with thin rind, very resistant to drought and extreme heat—the Mandarin, "Nagpur tangerine" (*C. nobilis deliciosa*), one of the oranges most liked in India.
- Juglans regia sinensis*. — No. 36 082 ; a walnut from Changli, Chili Province, North China. Its fruits is excellent. A decidedly hardier variety than the forms occurring in Europe, and northwest Asia.
- Mangifera indica*. — Nos 36 029 to 36 039 : Good varieties of India mangoes ; 2 come from the district of Mozufferpur where the rainfall is heavy, and may thus prove useful in the very wet parts of Porto Rico. No. 36 052 : "Pahutan mango" of Manila. On account of its great vigour, this variety will succeed best as a stock. No. 36 070 : "Diamond Mango" from the island of Chiloane, Mozambique.
- Nypa fruticans*. — No. 36 058 : from Manila, Philippine Islands : furnishes fuel, shingles for house-building, fibre for hats, mats, baskets etc., fruit for food or preserves. The sap is used, fresh, or fermented, as a drink, and for the manufacture of sugar, alcohol and vinegar. This species, one of the few that grow in brackish tropical tidal marshes, is of great use in turning the latter to account.
- Olea verrucosa*. — No. 36 059. An olive from Simondium near Paarl, Cape Province, Union of South Africa. Greatly resembles the European olive (*Olea Europaea*) which can be budded upon it ; this will perhaps allow of the extension of the southern limit of olive-growing.
- Pistacia integerrima*. — No. 36 065 : Introduced from Lahore, India as a possible stock for *Pistacia vera*.
- Prunus armeniaca*. — No. 35 701 ; an apricot from Monte Porcio Catone, near Rome, Italy. One of the best varieties known. Its cultivation in California is recommended.
- Prunus tomentosa*. — A Chinese bush cherry suited to the cold semi-arid parts of the North West of the United States. No. 36 109 : from Tientsin, China ; a variety with pale red fruits. No. 36 110 : from the same place ; has white fruit. No. 36 111 : from Pekin ; fruit sour.

#### VINES.

- Vitis vinifera*. — No. 36 040 ; vine from Sheharunpur, India, supposed to have come thither from the Punjab, and originally to have come from Afghanistan. Grapes seedless, of excellent flavour, but small in size.
- No. 36 041 ; a variety from Kabul, Afghanistan ; fruit of large size and excellent quality.

II — The second list, Nos. 36 259 — 36 936, includes the seeds and plants introduced into the United States from October 1 to December 31, 1913. Amongst the most important may be mentioned :

#### CEREALS.

- Avena nuda*. — No. 36 675 : a good variety of hull-less oats from Ta Shiang, Chihli Province, China, much cultivated in the higher mountain regions of northern China. A coarse flour is made from it.
- Avena sativa*. — Nos. 36 546 to 36 548. Varieties of oats from different provinces of the Russian Empire.
- Holcus sorghum*. — Nos. 36 610 to 36 616 : a good collection of varieties of sorghum from Do-



- doma, German East Africa; some have sacchariferous stems, others have edible grains giving good meal and beer. No. 36 639: "Dura sufa", from Khartum, Egyptian Sudan. Nos. 36 670 — 36 671: early-maturing varieties with dense heads and reddish-brown seeds, coming from Chihli Province, China. Fit for regions with short growing seasons. No. 36 672: dwarf variety of sorghum with large dense heads and white grains similar in origin and adaptation. Nos. 36 680 to 36 686; Sorghums from Victoria, Kamerun. No. 36 795: a tall-growing, white-seeded variety often producing several heads: from Chihli Province, China. No. 36 932; sorghum from Elim, German Southwest Africa. Nos 36 935 and 36 936; sorghum from Carignan, Ardennes, France (Denaiffe et Fils).
- Hordeum vulgare*. — Nos 36 345 and 36 346; barleys from Arequipa, Peru. No. 36 360: barley from Oruro, Bolivia.
- Oryza longistaminata*. — No. 36 533. Variety of perennial rice, (discovered by M. Ammann in French West Africa), from Jardin Colonial, Nogent-sur-Mame, France.
- Panicum miliaceum*. — An early-ripening millet with large yield, from Chihli Province, China. Fit for regions having short growing seasons.
- Pennisetum glaucum*. — No. 36 616; a variety from Dodoma, German East Africa. No. 36 655: variety from Nyassaland, Africa. No. 36 931: variety from Elim, German South-West Africa.
- Triticum* spp. — Nos. 36 388 to 36 390: wheats from Peru and Bolivia.
- Triticum aestivum*. — No. 36 392; wheat from Bolivia. Nos. 36 498 to 36 527; winter and spring wheats from Tashkend, Turkestan; very resistant to drought, even more so than *Triticum durum*. Nos. 36 577 to 36 587; wheats from Sydney, Australia. No. 36 622, "Gentile rosso" wheat from Bogliasco, Prov. of Brescia, Italy.
- Zea mays*. — Nos. 36 267 and 36 268; varieties of maize from Cuzco, Peru. No. 36 667; early ripening, flint maize from Pekin, China. No. 36 668: dwarf-growing white flint maize of early ripening habits from Hwai-Iai, Chihli Prov., China. Fit for regions with short growing season. No. 36 669; early ripening, dwarf maize with yellow flinty grain; suitable to same regions as the above. No. 36 699: maize with yellow flint grain, very productive, comes from Barbados. No. 36 710: maize with yellow flinty grain: from Rio de Janeiro, Brazil. No. 36 711: Red Peruvian maize with large starchy kernels from Rio de Janeiro, Brazil. No. 36 712 White Peruvian maize with starchy kernels, also from Rio de Janeiro. Nos. 36 889 to 36 895; varieties of maize from Chihli Prov. China.

## LEGUMINOSAE.

- Phaseolus angularis*. — Nos. 36 838 to 36 840: varieties of bean from Korea. Nos. 36 907; 36 910 to 36 912; 36 921 to 36 923; varieties from Manchuria.
- Phaseolus aureus*. — Nos. 36 909 to 36 920; varieties from Manchuria.
- Phaseolus coccineus*. — Nos. 36 476 to 36 478: varieties from Bolivia.
- Phaseolus lunatus*. — Nos. 36 479 and 36 481; varieties from Peru. Nos. 36 480; 36 482 to 36 484; varieties from Bolivia.
- Phaseolus vulgaris*. — Nos. 36 395 to 36 475; 36 861; 36 924: 85 varieties from Peru, Bolivia and Chile.
- Soja max*. — 38 varieties from Manchuria, China and Korea. Soja No. 36 785 is a wild variety from North China. The young pods are eaten boiled by the poorest Chinese; of value possibly as fodder plant when sown out among erect, growing plants, such as *Echinochloa frumentacea*, ("Barnyard millet").

## FORAGE PLANTS.

- Agropyron* sp. — No. 36 792: a vigorously growing grass found at altitudes of 5 000 to 8 000 feet.
- Astragalus* sp. — No. 36 790 of value as a soil binder in semi-arid regions and perhaps for forage purposes.

*Elymus dahuricus*. — No. 36 793 and *E. sibiricus*, No. 36 794 grow at altitudes of 7 000 to 9 000 ft.

*Erodium* spp. — No. 36 789 ; produces abundant forage.

*Geranium* sp. — No. 36 788 : a biennial cranesbill producing an immense mass of forage eagerly eaten by horses, mules and donkeys.

*Medicago ruthenica*. — No. 36 784 a wild lucerne from Chihli Province, China: a plant of spreading and semiascending growth. In moist places it forms a mass of herbage eagerly eaten by all grazing animals. It is found at elevations of 2 000 to 8 000 ft., and is most luxuriant at the highest altitudes.

*Medicago sativa*. — Nos. 36 551 to 36 560 : a collection of varieties from Poona, India.

*Vicia* sp. — Nos. 36 786 and 36 787 : varieties of vetch from Chihli, China ; very productive ; suitable to cold climates and mountainous regions. The second is found at an elevation of 6 000 ft.

#### MEDICINAL PLANTS.

*Artemisia maritima*. — No. 36 814 : rich in volatile oil and in santonin. Comes from Russia

*Contarea hexandra*. — No. 36 661 : a little tree from 6 to 17 ft. high, coming from Puerto Bertoni, Paraguay. The bark is much used in Brazil and Paraguay, as its medicinal properties are similar to the Cinchona. Though a plant of warm regions, it stands a temperature of 3° to 5° C. below zero, and probably could resist a lower temperature.

*Solanum aculeatissimum*. — Nos. 36 271 and 36 704 ; from Brazil. Can also be used as ornamental plants.

#### KITCHEN GARDEN PLANTS.

*Asparagus* spp. — Nos. 36 767 and 36 768 : These 4 varieties of wild asparagus coming from China, (Pekin, and Province of Chihli), can be used in breeding experiments and for bank-binding purposes in semiarid regions. The young shoots of *A. dauricus* are eaten by the Chinese. *A. trichophyllus* is an ornamental plant.

*Asparagus dauricus*, No. 36 766. — *A. trichophyllus flexuosus* No. 36 769.

*Beta vulgaris*. — No. 36 773 : A chard coming from the Province of Chihli, China ; suitable for alkaline soils.

*Brassica chinensis*. — No. 36 782 ; Summer cabbage from Kalgan, China.

*Brassica oleracea capitata*. — Nos. 36 299 — 36 300 — 36 302. Cabbages from Arequipa, — Chile.

*Brassica oleracea caulorapa*. — No. 36 770 : very large variety of kohl-rabi which can weigh as much as 25 lb. Comes from Chihli Province, China.

*Brassica Pekinensis*. — No. 36 781 : early winter cabbage with light-yellow heart leaves : from Kalgan, China. No. 36 783 : large winter cabbage, from Chihli.

*Capsicum annuum*. — No. 36 774 ; large, fleshy variety of Chile pepper suitable for alkaline soils : comes from Kalgan, China. No. 36 775 : medium-sized pepper more pungent than former ; from Kalgan, China. Nos. 36 776 and 36 777 ; strong peppers, elongated in shape ; from same locality.

*Cucurbita maxima*. — An excellent squash from Lima, Peru. No. 36 778 ; large, ribbed yellow, winter squash with green blotches : suitable for alkaline semi-arid lands ; comes from Kalgan, China. No. 36 779 ; squash suited for semi-arid soils ; comes from the Province of Chihli, China.

*Polakowskia Tacaco*. — No. 36 592 : a cucurbitaceous plant from San José, Costa Rica ; its fruit is one of the primitive foods of the Indians of Costa Rica, but it is also eaten by the Spanish Costa Ricans. The plant is cultivated, or semi-cultivated, on the central plateau.



- Raphanus sativus*. — No. 36 771 : red, or green winter radish ; comes from Chihli Province, China. No. 36 772 : long, white, autumn radish from same locality.  
*Solanum quitoense*. — No. 36 597 : from Colombia : its fruit resembles a tomato.

## ORNAMENTAL PLANTS.

- Acanthopanax* sp. — Nos. 36 733 and 36 734 : spiny shrubs, met with at altitudes of 7 000 to 9 000 ft, from Chihli Province, China.  
*Albizia julibrissin*. — No. 36 810 : beautiful ornamental tree from Pekin, China : can be used as shade-giving tree.  
*Amygdalus davidiana*. — No. 36 807 : wild pyramidal peach growing 50 to 60 ft. high: suitable for dry climates ; appropriate for cemeteries to replace the cypress.  
*Artemisia* sp. No. 36 797. — Biennial plant from Pekin. Used in China as stock for chrysanthemums which, when thus grafted, are earlier and stronger. The introduction of *Artemisia* might extend the northern limit of chrysanthemum cultivation.  
*Berberis chinensis*. — No. 36 737 : an ornamental, dwarf barberry from the mountains of the Province of Chihli, China.  
*Cornus* sp. — Nos 36 741 and 36 742. Decorative mountain shrubs from above locality.  
*Hippophaë rhamnoides*. — No. 36 743 : buckthorn occurring on seashore of Europe and in the higher parts of Asia. Of value possibly as hedge plant for cold semi arid region. From same locality.  
*Iris ensata*. — No. 36 765 : vigorously growing strain, from same locality : suitable for roadside plant in dry districts : is a good garden tying material.  
*Larix dahurica*. — No. 36 728 : mountain larch (6 000 to 10 000 ft.) Of value possibly as ornamental park tree for cooler regions.  
*Lychnis coronata*. — No. 36 764 : a perennial mountain *Lychnis* with brick-red flowers : from the same locality.  
*Nitraria Schoberi*. — No. 36 800 : variety from Tientsin, China. Of value possibly as a soil and sand reclaimer for alkaline regions.  
*Ostryopsis Davidiana* — No. 36 731 : a spreading ornamental shrub from Chihli Province, China. Of value as cover plant for banks and stony places.  
*Picea obovata*. — No. 36 729 : an ornamental, blue, mountain spruce from the same locality. Of value possibly for cold dry regions.  
*Prunus* sp. No. 36 722 ; a wild shrubby plum, from the same locality. Possibly useful in hybridisation experiments.  
*Prunus humilis*. — No. 36 721 : plum similar to preceding from the same locality and suitable for same purpose.  
*Prunus padus*. — No. 36 723 : a mountain bird-cherry from the same locality. Of value for parks in cold regions. In Siberia, the fruits are eaten.  
*Prunus triloba*. — Nos. 36 718 to 36 720 : ornamental plums from same locality.  
*Rosa* spp. Nos. 36 857 to 36 859: wild mountain roses from same locality—might serve in crossing experiments, or as stocks.  
*Sambucus racemosa*. — No. 36 744 : ornamental elder growing on poor soils ; suitable for cold regions.  
*Sorbus* sp. — No. 36 730 : very ornamental mountain rowan from same locality.  
*Viburnum opulus*. — No. 36 732 : very ornamental snowball for cold regions : comes from same locality.  
*Viburnum plicatum*. — No. 36 855 : see above.

## FRUIT TREES AND SHRUBS.

- Aleurites montana*. — No. 36 574 : variety with oil-bearing seeds ("wood-oil-tree"), from southern China.

- Amygdalus Davidiana*. — No. 36 664 : wild peach tree from Pekin, China. To be used for stocks for grafting.
- Annona cherimola* × *squamosa*. — No. 36 562 : Hybrid obtained at the Plant Introduction Station, Miami, Florida. Fruit excellent, flavour intermediate between that of the parents.
- Annona diversifolia*. — No. 36 632 : red-fleshed anona from Mexico.
- Annona muricata*. — No. 36 294 : from Lima, Peru. — No. 36 532 : from Honolulu, Hawaii. — No. 36 700 from Bridgetown, Barbados.
- Bactris utilis*. — No. 36 573 : palm from San José, Costa Rica : the fruits, when cooked, have a taste much resembling that of the potato, they form in many places one of the principal foods of the Indians near San José.
- Berberis heterophylla*. — No. 36 626 : edible species of *Berberis* growing on the foot hills of the Corderillas and coming from Chubut, Argentina. Fruits edible, blue, with sweet taste resembling muscat grapes.
- Carica papaya*. — 36 275 to 36 278 : Four good varieties from Minas Geraes, Brazil.
- Crataegus pinnatifida*. — No. 36 801 : A large-fruited variety of edible hawthorn from Pekin, China.
- Diospyros lotus*. — No. 36 808 : a wild persimmon from the same locality. Can be used as stock for grafting *Diospyros virginiana* and other varieties.
- Eugenia tomentosa*. — No. 36 713 : a variety from Rio de Janeiro, Brazil with orange-yellow, aromatic, juicy fruits.
- Malus* sp. — No. 36 601 : Crab apple from Shantung, China, admirable grafting stock.
- No. 36 803. Crab apple with fruit the size of a large cherry, of dark purple colour making excellent compote.
- Morus alba*. — No. 36 696 : Mulberry from Rio de Janeiro, Brazil, may prove of value for the manufacture of jams and preserves.
- Persea americana*. — Nos. 36 603 and 36 604 : excellent varieties of avocado from Honolulu, Hawaii, whither they were imported from Guatemala. No. 36 687 : a good variety from Iagás, Mexico.
- Prunus* sp. No. 36 607 : very hardy plum ; its yellow fruits have a fine aroma : comes from Siberia.
- Prunus salicifolia*. — No. 36 371 : a wild cherry from Cuzco, Peru, where it grows at an altitude of 8 000 at 9 000 ft. Promises well as grafting stock for sweet cherries.
- Pyrus* sp. — No. 36 802 : fruits, very small pears of russet colour, with a long peduncle: comes from Pekin, China.
- Rollinia orthobotala*. — No. 36 561 : Seeds obtained from the " Plant Introduction Field Station " of Miami, Florida. Grows on land which is often flooded at Para at the mouth of Rio des Amazonas and bears a delicious fruit resembling that of *Annona Cherimola*.
- MESSRS P. H. DORSET, A. D. SHAMEL and WILSON POPENHOE made an exploring expedition to South Brazil at the end of 1913, and brought back the following species amongst others :
- Citrus sinensis*. — Nos. 36 635 ; 36 637 ; 36 689 ; 36 691 ; 36 692, Bahia navel orange, from which has been derived the " navel Orange " cultivated in California (1).
- Citrus aurantium*. — Nos. 36 636 ; 36 694 ; 36 707 ; " butter orange ", Laranja da terra " of Rio de Janeiro should be grown in Florida and California.
- Mangifera indica*. — Nos. 36 688 and 36 841 : the " Rosa mango " of Rio de Janeiro.
- No. 36 690, the " Augusta mango " of the same locality.
- Myrciaria cauliflora*. — Nos. 36 702 ; 36 709 ; 36 888 ; the " jaboticaba " of Rio de Janeiro ; very common in Brazil, is one of the best and handsomest fruit trees. Should be cultivated in Florida and California.

(1) See B. January 1916, No. 67

(Ed.)



PROF. S. C. MASON brought back from his scientific travels in Egypt and Nubia a collection of 12 date palms (2) growing in the Egyptian Sudan: *Phoenix dactylifera*, Nos. 36 676 : 36 818 to 36 828. He also discovered at Merowe, *Dodonaea viscosa* (No. 36 813), a subtropical plant used for hedges, which will be tried for this purpose in Florida and California.

At the end of 1913, MR FRANK, N. MEYER explored the Province of Chihli, China and brought back the following species, in addition to those already mentioned as coming from this province:

*Amygdalus persica*. — No. 36 805 : A peach (from Pekin) with white fruit ripening in winter ; flesh hard, but sweet. No. 36 806 : peach (from Kalgan) fruit late, of good quality, but not very sweet.

*Castanea mollissima*. — No. 36 666 : chestnut (from Pekin) of no use for timber, but seems more resistant to *Endothia parasitica* than the American chestnuts, therefore it might be used in hybridisation experiments to combine the good qualities of the American and Chinese parents into one tree.

*Corylus* sp. — No. 36 726 and 36 727 : wild mountain hazels suitable for cold regions.

*Prunus salicina*. — No. 36 804 : a variety of plum of wine-red colour, said to be as large as an apple. Of value possibly for the cooler sections of the United States.

#### VINES.

*Vitis amurensis*. — No. 36 753 : very hardy grape from Chihli Province, China, where it is found at elevations of over 5 000 ft. (brought back by MR F. MEYER). Fruits small, but edible. Of value as a porch and arbour vine ; may be used in hybridisation experiments in order to obtain hardier vines for the colder sections of the United States.

19 — **The Determination of the Dry Matter in Beets.** — KRISTENSEN, R. K., Director of the Danish State Institution for Experiments in Plant Cultivation (Section for Chemical Investigation of Edible Plants).

Every year a large number of determinations of dry matter in roots are made in Denmark. Such determinations are associated with the various branches of investigation : the agrico-economic testing laboratory's investigations respecting fodder, the State testing operations for the cultivation of plants and the local field tests undertaken by the agricultural associations. In addition, dry matter determinations are made for improving roots for seed purposes and for controlling cattle-feeding (control associations). In addition to the laboratories associated with the State testing work, a number of private laboratories undertake determinations of dry matter for a moderate charge. As a rule the procedure is that indicated below as regards the main lines of investigation, and it is based upon various exhaustive tests. An account of the chief points of these tests is given with a more detailed description of the method itself.

In ascertaining the dry contents of roots the method of sampling is very important. Firstly one or more samples of the roots to be tested are taken, each sample consisting of a certain number of roots. From them specimens are again chosen, the plants being divided and samples drawn of the individual roots. The material thus obtained is then used for the final selection of specimens for the actual test.

When drawing the first samples, as many roots must be taken as is sufficient to represent the whole number of roots to be tested for their dry matter. At first it was customary to draw samples consisting of three or four roots, but the result was so uncertain that the test was valueless, so that after a while larger and still larger specimens were taken, the maximum of about fifty roots being ultimately reached. A series of double analyses undertaken by the State testing stations in 1902 showed that the difference between two such samples could be as great as 0.5 per cent of dry matter. In 1903, L. HELWEG discovered that the dry contents of sixty samples taken from the same picked lot of mangolds varied from 13.67 per cent to 15.59 per cent. Each sample consisted of fifteen roots, and the standard deviation of the single samples was 0.36 per cent of dry matter. According

to the law of error this would make the standard deviation  $\sqrt{\frac{0.36}{\frac{50}{15}}} = 0.20$

per cent. of dry matter, for samples of fifty roots. Subsequent calculations undertaken respecting a large number of determinations of dry matter in mangolds cultivated and analysed by the State testing stations in the years 1907-1909, showed that the average standard deviation in respect of single samples of fifty roots was 0.18 per cent of dry matter. If the roots are to be sent to a laboratory and probably kept for some time before the test can be made, a greater standard deviation may be looked for than when they are to be treated on the experimental grounds themselves. In 1909 R. K. KRISTENSEN tested 215 single roots (mangolds), and found that the variation in the dry contents of the individual plants account for the variations in that of the big samples. The weight of the roots varied from 102 grm. to 1745 grm and the dry content from 8.02 per cent. to 13.76 per cent. The standard deviation in the dry contents of the individual plants was 0.93 per cent, but if calculated in respect of roots of the same size, 0.84 per cent. The roots weighed on an average 817 grm. each, the average of dry contents being 10.88 per cent. If the standard deviation of the individual contents of dry matter be 0.84 per cent, the standard deviation in samples of 50 roots will be according to the law of

error  $\sqrt{\frac{0.84}{50}} = 0.12$  per cent. At the testing station in Askov, where these

investigations were carried out, the actual standard deviation in the case of a large number of samples of fifty mangolds was 0.15 per cent of dry matter. The slight difference, 0.03 per cent, is easily accounted for by the fact that the 215 roots had grown side by side, whilst the samples of fifty roots referred to tests on comparatively large stretches of land. — Repeated tests have demonstrated that the small roots have a higher dry content than the large ones, and the samples drawn must be of the same average size as the roots which the test is to represent.

This can be done by drawing roots of medium size and also of various sizes. But calculations have demonstrated that the dry content arrived at will be somewhat too high, if medium-sized roots only are taken and



it is therefore advisable to make the desired test with roots of various sizes. In the case of very exact tests the very elaborate process has been resorted to of sorting out the roots into three classes according to size, and ascertaining the numbers of small, medium and large roots, after which the tests are compounded in accordance with the results obtained.

Formerly various methods were adopted for *the testing of the individual roots*. Cubes have been bored out of the roots or small pieces cut, or else a wedge-shaped incision has been made in one side of the root by means of a machine suitable for the purpose. But all these methods are defective, because the dry matter is not evenly distributed throughout the whole. The outside is richer in dry matter than the inside, and beets contain more dry matter at the two sides from which the fibres run than in the smooth parts between. The only correct method is consequently to saw the root through several times crosswise with a machine constructed by L. HELWEG and take out the final samples from the heap of parings. R. K. KRISTENSEN has found that the dry contents of the samples thus obtained correspond to the actual dry contents, when the saw is kept sharp and in good order; this has been confirmed by other tests. It also appeared that the *final tests of the accumulated parings*, the so-called pulp, can be carried out with great accuracy. Twenty-four samples were drawn from this pulp of about twenty grammes apiece. The dry contents varied from 11.45 to 11.56 per cent. The standard deviation of the individual samples was only 0.03 per cent of dry matter. A statistical treatment of a large number of determinations of dry matter undertaken by the State testing station at Askov from 1905-1911 substantiated this result.

*The drying of the root pulp* must take place at a comparatively low temperature. V. STORCH stated in 1905 that drying should be done at a temperature below boiling point, otherwise a partial separation of the pulp occurs, with the result that some of the dry matter is lost through the drying. A. MADSEN-MYGDAL AND P. CHRISTENSEN found subsequently that these conversions were associated with direct reducing sugars and that they caused a loss of dry matter about half as great as the diminution of the sugar contents. Therefore great care must be exercised in the drying of swedes and turnips, which practically contain nothing but direct reducing sugars. In beets the sugar is present in the autumn in the form of cane sugar, which stands drying at a higher temperature, but during the winter a portion of the cane sugar is split up into invert sugar which will not stand a high temperature.

There may be practical difficulties connected with drying at such low temperatures so that the said conversions of reducing sugars can be entirely avoided. In order that the results may be compared, the drying temperatures must be the same and kept as uniform as possible. Where there is a vacuum apparatus at hand, the samples can be dried much more easily under reduced atmospheric pressure. Permeating with gas would not, however, appear to prevent metabolism taking place as mentioned.

*Procedure adopted for determining dry contents of beets.**1. Taking samples.*

Each test is made with fifty roots at least. Two, four or eight equal samples (joint samples) are drawn, according to whether very extreme accuracy is required or not. In comparing various roots, at the State testing stations four joint samples are used, but in the case of tests as regards feeding properties, eight. The taking of samples varies somewhat, according to whether they are needed for field tests and take place on the spot, or if they have to do with tests for feeding values, in which case the samples are drawn from a collection of roots. In the latter instance five hundred roots are counted out from the store of roots, one hundred roots being taken from five different places. The five heaps are weighed, and the average weight of fifty roots calculated.

For each analytical test ten roots are drawn from each heap, the idea being to have the different sizes represented in the sample, but the rare very large and very small roots are not included as such highly abnormal individuals could easily be too largely represented in the comparatively small sample. The samples drawn are weighed, and by exchanging small and large roots the weight is made to correspond to the average weight existing.

In the case of field tests the plan is usually adopted of weighing and counting the roots on each plot of ground before samples are drawn, and thus it is easy to calculate the mean weight. For each test equal numbers of roots are taken from each of the plots belonging to the same property, they being chosen, as in the previous instance, of different sizes. A sufficient number of roots are taken from each plot to make up an aggregate of at least fifty roots. The samples are weighed, and made to correspond with the average weight as before. If the roots cannot be analyzed immediately after being drawn, the samples are placed in hogs in the ground in such a way as to be protected from frost, earth being placed round each single root. Care must be taken that they do not dry between drawing and soiling up. As the dry contents can undergo alteration during storage this should not be protracted more than absolutely necessary. While the analysis is proceeding the samples are taken up as required from time to time.

*2. Washing and sawing.*

The roots are cleansed by means of a washing machine consisting of a vat two metres long filled with water, in which a drum containing the roots revolves. The drum is about 60 cm in diameter and calculated to contain a sample lot *i. e.* about fifty roots at a time. It is made of battens two cms. apart, and has a cover which is opened when the roots are put in or taken out. After being taken out of the washing machine, each root is carefully looked over, the earth adhering to it is removed with a sharp flat stick and a hard brush. Then the roots are laid out to drain off for several hours before they are sawn, being placed in flat crates or on a layer of straw.



The sawing is done with the above mentioned sawing machine consisting of a table on which is fixed a circular saw worked by hand or driven by power. The roots are cut transversely in slices of a certain thickness; the slices are brushed by the hand through an aperture in the table down into an oblique wooden shoot, down which they fall into a zinc box under the saws beneath the table. Half of the table can be removed and raised when the pulp is to be emptied out of the box, which can be unhooked from the machine. A tin screen is fixed over the saw to catch what it throws up. On the table a lath is placed, which makes it possible to maintain a regular distance between the cuts. The distance is regulated so as to get a suitable quantity of pulp (about 1 kg.) from each sample. Equal distance must be maintained between the incisions as long as each sample lot is being sawn, irrespective of the fact whether the root is large or small, or what shape it is. Five cms. will generally do.

The blade of the saw must not be too thick, preferably not over one mm. The teeth should be small (about two per cm) and oblique, as in an ordinary saw. They must be sharp, and set in such a way that the blade can pass freely through the beet. The teeth should be filed obliquely, so that the tooth projects in a point on the side on which it is set; if this is not done, the parings can easily hang together in long strips. The saw must not work backwards and the same speed must be maintained, therefore it is better for it to be driven by power than worked by hand. If the testing of the pulp cannot be done at once it should be put in a preserving glass or tin box with a tightly fitting cover, which must be kept until the final samples are weighed. This should be done, however, on the same day as the sawing.

### 3. *Drawing samples from the pulp and treatment of the samples selected.*

The pulp is poured into a porcelain dish and carefully mixed. The soft and comparatively liquid pulp from mangolds is mixed by vigorous stirring, whilst pulp from the other kinds of roots which have a firmer consistence must be kneaded. The joint samples of 10-15 grms are taken out with a small spoon, the pulp being stirred again before each sample is drawn. The samples are put into cylinder glasses 60 mm. high and 45 mm. in diameter, having figures etched upon them. The 10-15 grms. of pulp put into each glass is distributed with the back of the spoon into an even layer on the inside of the glass. The easiest way to do this is to employ two men; one mixes the pulp and puts it into the glasses, the other weighs them. The samples are then placed in the drying apparatus. An ordinary thermostat is used with a water jacket and an automatic regulator. Where there is no gas on the premises, the thermostat can be heated by a petroleum lamp, but it is more difficult then to regulate the temperature. There must be an ample current of air through the thermostat, in order that the large quantity of vapour developed in the first stage of the drying can escape. Vapour should not escape from the drying chamber when the lid is taken

off. The samples should remain in the thermostat for twenty-four hours at a temperature of 80° C. They are then taken out and placed in dessicators over concentrated sulphuric acid. One must be satisfied perhaps by drying some of the samples again — that the drying has been complete. An incomplete drying can result from there being many samples in the chamber, with an insufficient air current, or if the samples are too large and the pulp is not carefully distributed in the glass. This may also occur if the regulating is defective and the temperature is allowed to drop. The glasses are weighed upon an ordinary chemical balance, but others of a less fine make can be used. The percentage of dry matter is calculated, and an average of the three joint samples from the same pulp is taken and then the mean figure for the two, four or eight samples of beets in the same category is arrived at.

20 — **A Contribution to the Knowledge of the Chemical Composition of the Leaves of *Rubus*.** — AUGUSTIN B., in *Botanikai Közlemények (Botanische Mitteilungen)*. Vol. XV, Nos. 3-4, pp. 94-96. (Author's Summary in German on pp. 29-30). Budapest, Nov. 4, 1916.

The Author has studied bramble leaves collected by school children in order to serve as a substitute for tea in the army. In 1914 nearly 1970 cwts were collected from about 12 000 localities in Hungary. The material sent to the Author was very varied, for under the name "bramble-leaf" numerous species of *Rubus* together with numerous hybrids had been collected. Two chief types could be separated from the whole: 1) leaves from low-lying land, usually belonging to the group of *Rubus caesius*; 2) leaves coming from hilly land and approximating to the group of *R. tomentosus*.

A large number of analyses were carried out; the results showed much variation, as might be expected from such heterogeneous material; the outside values were as follows:

The dry leaves of *Rubus* were very hygroscopic, their water-content varying according to the season: on dry days varying from 5.3 to 6.8 %; on rainy days from 8.5 to 9.17 %.

The ash-content of leaves incinerated at 100° C. varies from 5.24 to 9.3 %.

The water extract varies between 38.6 and 43.32 %; its ash-content between 8.48 and 9.21 %.

The total nitrogen obtained by the KJELDAHL method, varies between 2.52 and 2.73 %; the crude protein calculated from the total nitrogen ( $N \times 6.25$ ) between 15.8 and 17.0 %.

The tannin content was estimated by titrating with  $\frac{N}{10}$  potassium permanganate solution, assuming 4 mg. of permanganate as equivalent to 1 mg. of tannin. By this means, 9.3 to 12.8 % of substance oxidisable by the permanganate was obtained, but about one third of this amount is not tannic, for if the tannin is eliminated by adding powdered leather, there still remains matter oxidisable by permanganate, excepting that absorbed by the powdered leather.



Some leaves after drying had a delicate aroma, similar to that of tea; others, on the contrary, were devoid of any aroma. Leaves moistened with water and left to macerate in a warm place assumed a peculiar flavour somewhat like coumarin. The appearance of this aroma is probably related to the action of hydrolytic ferments similar to those found in *Rosaceae*.

The high albumen content of the leaves suggested their utilisation as forage. The Director of the Zoological Garden at Budapest tried some feeding experiments with these leaves, and found that they were eaten with relish by deer.

21 - **A Bacterial Test for Plant Food Accessories (Auximones).** — BOTTOMLEY W. B., in *Proceedings of the Royal Society (Biological Sciences)*, Series B, Vol. 89, No. B 610. London, August 2, 1915.

The nutrition of a plant depends, not only on the supply of mineral food substances, but also upon the presence of certain accessory food substances, or auximones (= promoting growth), very small amounts of which are sufficient to satisfy the needs of the plant. Hitherto the only means of demonstrating the presence of auximones has been their action on the higher plants. Experiments showed that the auximones in bacterised peat produced an increase in soil nitrification. This suggested that liquid cultures of the nitrifying organisms might provide a test for plant auximones. It was further found that a scum was always formed on the surface of the liquid whenever the auximone was added to the crude nitrifying culture from soil. The organisms forming the scum are, as yet, unidentified, but they are widely distributed in soil, and easily obtained. Again, the amount of scum formed was found to increase progressively with the quantity of auximone present above a certain minimum. More extensive tests showed that the scum formation is due to the specific action of auximones. The accessory substances concerned with animal nutrition were also found to induce scum formation. Thus, it is evident that the scum-forming organisms can serve as a qualitative test for food accessories in general. Having the indicator for auximones, other material can be examined for their presence.

Auximones were found in the root nodules of leguminous plants. The scum-forming organisms require no organic carbon for growth and, like nitrifying organisms, can assimilate atmospheric carbon dioxide by chemosynthesis. Further, they are obliged to obtain their nitrogen from an ammonium salt, as they cannot make use of nitrates.

The plant auximones so far investigated differ from those concerned with animal nutrition in that they are not destroyed by heat, as they can withstand a temperature of 134° C. for half an hour without losing their properties.

22 - **The Relation of Transpiration to Assimilation in Steppe Plants.** — HJIN V. S., in *The Journal of Ecology*, Vol. IV, No. 2. Cambridge, June 1916.

The results of numerous researches made by the writer on the steppe reservation in the Government of Voronezh, for the purpose of studying

the relation of transpiration to assimilation in species of plants growing in arid regions.

When the decreased intensity of the transpiration process, by which the plant reduces its water consumption, is due to the partial closing of the stomata, a smaller quantity of carbon dioxide is absorbed and consequently the assimilation is diminished. For this reason, a plant will be better adapted to growing in dry places, the more it is provided with protective arrangements which allow it to reduce the loss of water to a minimum even while keeping the stomata open and without interrupting assimilation. Such protective devices are the sinking of the stomata, hairiness, and reduction of the evaporating surface.

Without mentioning the technical details of the experiments, we may summarise the most important results as follows:

1) Plants possessing xerophytic organs (xerophytes) lose less water per unit of decomposed carbonic acid than plants living in a damp locality (mesophytes). Thus for every cc. of carbonic acid decomposed *Stipa capillata* (arid steppe) lost 160 cg. of water; *Coronilla varia* (grass steppe), with a ratio of 100 : 14, lost 1176 cg. In another experiment, *Stipa capillata* only lost 125 cg. and *Aristolochia clematitis*, a true mesophyte, lost 544 cg. Naturally, the plants examined were kept under uniform conditions during all these experiments. 2) Mesophytes must close their stomata in dry places, in order to reduce evaporation, thus also diminishing the rate of assimilation, whereas in the case of xerophytes, assimilation in similar circumstances proceeds actively. Under normal conditions, *Geranium pratense* (mesophyte) assimilates 24.54 cc. of  $\text{CO}_2$ ; *Stipa capillata* 7.91 cc.; *Phlomis pungen* (arid steppe) 7.84 cc. In other experiments we have, *Senecio doria* (meadow steppe), 14.71 cc., *Phlomis pungens* 6.60 cm. On the other hand, when *Geranium pratense* is transferred to the arid regions of the steppe, the intensity of the assimilation process may entirely cease; in the case of *Senecio doria*, the amount of carbonic acid assimilated falls from 14.71 cc. to 2.14 cc., while *Stipa* and *Phlomis* continue to develop normally. Thus we find that mesophytes, on being transferred to a dry place, reduce their assimilation till it is even less than that of xerophytes.

3) In consequence of the greater amount of moisture in the environment, mesophytes lose, under normal conditions, less water per unit of time than xerophytes; if however the mesophytes were transferred to dry places, their transpiration would increase to a greater extent. In the case of *Senecio doria*, the loss of water per unit of  $\text{CO}_2$  was doubled, in the case of *Geranium pratense*, it was 3 times as great; in *Galeopsis ladanum* almost 10 times, and in *Aristolochia clematitis* about 31 times.

Taking as a basis their higher or lower degree of xerophily, the writer divides the species examined by him into the following groups.

1) *Aristolochia clematitis* and *Galeopsis ladanum* in wet hollows where rain collects most and remains longest.

2) *Geranium pratense*, *Trifolium montanum* and *Betonica officinalis*, in shallow ravines and the meadows bordering them.



3) *Senecio doria* and *Coronilla varia* on meadow steppes.

4) *Centaurea orientalis*, *Amygdalus nana*, *Caragana frutescens* and *Stipa capillata* in the drier and more elevated parts of the steppe.

The conclusions reached by the writer and the method he has devised are of considerable importance, not only to physiology in general, but also from the point of view of the selection of drought resistant types. The transpiration factor alone is not a sufficient criterion. A rather low transpiration index only shows that the plant, or species in question loses little water, but gives no information as to its powers of assimilation, and therefore of its productivity. The breeder of maize should thus not limit his choice to the selection of individuals with a low rate of transpiration (those resistant to drought) but, on the contrary, aim at the creation of types which combine feeble transpiration (*drought resistant*) with relatively intense assimilation (*highly productive*).

### 23 - The Relation of Soil Moisture to Transpiration and Photosynthesis in Maize. —

YUNCKER T. G., in *Plant World*, Vol. 20; No. 6, pp. 151-161. Baltimore, Md., June 1916.

Experiments to determine the relation between the amount of transpiration and of photosynthesis in corn plants and the degree of soil moisture in which they were grown. The soil moisture was kept at three degrees, viz: 25, 45, and 65 per cent of total saturation.

The amount of transpiration was obtained by continuous weighings of potometers, and the water used by the plants was recorded. The amount of photosynthesis was determined by measuring the weights of a given area of the plants at fixed intervals. To prevent evaporation, glazed potometers were used and the soil surface was sealed with wax, the young maize plants being protected by paper. At the end of the experiment the soil showed a loss of from 1 to 5 % of the initial moisture. The relations between transpiration per unit of leaf area and soil moisture are shown in two tables. It was found that the water requirement was less for plants in the drier cultures in all experiments, being least in the 25 per cent, most in the 65, and intermediate in the 45 per cent. The rate of transpiration in grams of loss per sq. metre per hour showed the same relation to moisture content as did the water requirement. Thus it appears that the amount of organic matter formed is not proportional to transpiration. The amount of transpiration varied much from day to day, but was approximately constant for the three series. The variations may be ascribed to environmental changes.

The photosynthetic experiments were designed so as to find the relation between the weights per unit area of leaf surface at different periods of the day and at the 3 degrees of soil saturation. Plants in the dry soil weighed most per unit area, the medium next, and the wet the least. The maximum increase in dry weight per unit area took place about noon and then decreased towards evening. After dark the unit dry weight gradually decreases till daylight, the maximum loss occurring before midnight. The relation between the three cultures remained about the same for the 24 hours.

24 - **Germination Tests of the Seeds of Garden Cress (*Lepidium sativum*) under very varied Conditions.** — LESAGE PIERRE, in *Comptes Rendus des Séances de l'Académie des Sciences*, 1916, Second Half-year, Vol. 163, N° 18, pp. 486-489. Paris, October 30, 1916.

The results of numerous experiments carried out at different times.

*In potash solutions.* — This test shows a method for indicating the germinating power of seeds without awaiting their actual germination. On placing in a  $\frac{1}{128}$  N. potash solution, the seeds that colour the solution yellow will not germinate, while those causing no coloration will germinate.

*In alcoholic solutions.* — Tests with alcoholic solutions of varying dilution showed that the limits of germination are expressed by a curve formed by taking the length of immersion for the ordinates and the amount of dilution for the abscissae.

The curve is concave at the top and shows three interesting points, the most important being that which corresponds to the limit of germination after immersion in absolute alcohol. It corresponds to the dilution zero and to an undetermined time, but which exceeds 4 years 7 months. It is thus evident that seed may be kept for a long time in absolute alcohol without injuring the germinating power.

*In saline solutions.* — Tests in solutions of chlorides, nitrates, sulphates of potassium, sodium, ammonium, resulted in curves similar to those of alcohol. Formed by taking the gram-molecular concentration as abscissae, the curves are far from coinciding; it may be deduced that, if the osmotic pressure of these solutions comes into play, it does not control the phenomena alone. On the other hand, in finding the limit of gram-molecular concentration below which germination will still commence in the saline solutions, and above which germination is stopped, it is found that the limit is about 0.4 mol., showing that osmotic pressure plays an important part in the germination.

*Influence of the method of sampling, the duration of immersion, of the germinating chamber.* — In tests after prolonged immersion in alcoholic solutions, in saline solutions, or even in spring water, the method of sampling and the length of immersion, time during which the embryo may asphyxiate, and the death of the embryo may result from the exosmosis of more or less toxic products, must be taken into account.

The tests of seeds taken out of the solutions being made in a germinating chamber, the nature of the chamber influences the results. Germination takes place better between moist blotting paper than in wet moss, in damp earth or on a thin film of water. Between boiled blotting-paper it is still better. Finally, on a thin film of oxygenated water, suitably dilute, germination takes place when it will not do so under other conditions.

*In petroleum ether and ordinary ether.* — Garden cress seeds still retain the power of germinating after remaining 4 years 7 months in petroleum ether. Their germination power is quickly lost in ordinary ether.

*In moist air.* — On flame-sterilised paraffin floats, floating on distil-



led water in a glass-box hermetically sealed, the seeds of *Lepidium sativum* could germinate; but there are large individual differences and the germination number depends on the temperature, so that, even at about the optimum temperature (21° C), the variation could be considerable.

Seeds that had not germinated with a water-saturation equal to 1 had not lost their germination power after 5 months. Garden cress seed did not germinate in damp air with less water saturation than 1, for instance equal to 0.98. As regards age, 1 month old seed had not germinated after 20 days, with water saturation unity, when grains of 1 to 5 years germinated after the third day under the same conditions.

*In oxygenated water.* — Old or young seed, but more or less altered by the medium in which they were placed, can still germinate in oxygenated water suitably diluted and renewed, while they germinate badly or not at all under other conditions.

An experiment on old seed gave: out of 10 seeds, 8 years old, after 14 days on spring water, between moist blotting paper, on water with 0.45 vol. of oxygen, 5 produced 1 to 2 mm. of radicle in the first case; 6 produced 2 to 5 mm. of radicle in the second, and 5 have freed the young plant in oxygenated water. In solutions obtained by diluting water containing 6.8 vol. of oxygen by  $\frac{1}{2}$ ,  $\frac{1}{3}$ ,  $\frac{1}{8}$ , etc., germination still took place in the  $\frac{1}{4}$  strength dilution, but not in the  $\frac{1}{2}$  strength. The action of the oxygenated water is improved by renewing the water every day; it should be noticed that, in cultures on a thin film of water, changing the water every day produces similar effects.

Oxygenised water, suitably diluted, at first favours germination, but the young plants are retarded in their development, remaining short and squat (1).

*Graduated Germination.* — Seed that had commenced germination in moist air at a water saturation of 1, then placed in a water saturation of 0.87, ceased germinating; after 10 days stoppage, the same seeds recommenced germination after being placed between moist blotting paper. The author has thus obtained "interrupted germination" so called by TH. DE SAUSSURE, but by another method.

#### PLANT BREEDING

25 - On the Inheritance of Certain Stem Characters in *Sorghum*. — HILSON G. R. (Deputy Director of Agriculture, Northern Division, Madras Presidency) in *The Agricultural Journal of India*, Vol. XI, Part II, pp. 100-155, 1 plate. Calcutta, April, 1916.

Attention has already been drawn (2) to the occurrence in some strains of selected *sorghums* of two distinct types differing as regards the appearance of the midrib of the leaf. In one the midrib appears as an opaque white band running the whole length of the leaf, while in the other the mid-

(1) Compare DENVOUSSY, Influence of oxygenated water on Germination in *Comptes Rendus de l'Académie des Sciences*, 1916, Vol. 162, N° 12, pp. 435-438. The author commenced his experiments through reading this communication.

The communication is abstracted in *B.* June 1916, N° 627.

(Ed).

(2) BENSON and SUBBA RAO. The Great Millet or Sorghum in Madras. *Bull. Dept. Agr., Madras*.

rib of the lower leaves is marked by a dull white, generally broken, band, never extending across the full length of the midrib and rarely to the end of the leaf; in the upper leaves the midrib is devoid of any white marking whatever.

A greyish midrib has been definitely shown to be associated with a stem rich in sugar, a white midrib to be associated with a dry pithy and tasteless stem.

Tests have now been carried out on the inheritance of these characters with the result that the pithy character of the stalk has been shown to behave as a simple dominant to the sweet-stalked character. The differences in the characters of the midribs of the leaves do not become apparent in the plants until these latter are about 6 to 7 inches high.

26 - **Studies on the Correlation of Characters in the Oat Plant, in U. S. A.** — LOVE H. H. and LEIGHTY C. E., in *Cornell University Agricultural Experiment Station, Memoir No 3*, pp. 1-70. Ithaca, N. Y., 1916.

The numerous researches on oats have undoubtedly contributed considerably towards their improvement but a great deal yet remains to be learned as to variation in this plant and correlation of its characters. For instance, we are still ignorant as to whether there exist characters capable of providing a sound basis for selection or if, speaking generally, the whole of the anatomical characters vary during the progress of the season to such a point as to exclude their use as a means of progressively improving the plant. Similarly with regard to correlation of characters: it still remains to be seen whether characters capable of correlation are subject to changes in their mutual relations from year to year following seasonal changes, or whether, on the other hand, they are sufficiently stable to furnish a sound basis for the breeder. One is stimulated to put the following questions:

- 1) Do the tallest plants produce:
  - a) the largest amount of seed?
  - b) the biggest grains?
- 2) In proportion as the culms increase in number:
  - a) is there a corresponding increase in the yield of grain per culm?
  - b) does the average number of grains per culm increase or diminish?
  - c) does the average weight of a grain increase or diminish?
- 3) Do these various relationships remain unchanged from year to year?

In order to answer the above questions researches were made into the variation and correlation of various characters in the oat plant, even under varying environmental conditions, during the period 1909-1912. The whole of the material examined was derived from a pure strain of the "Sixty Day" variety, isolated and sown in 1907. In 1909 analyses were made of 500 entire plants; in 1910 and 1912, of 400 plants (1). No material was examined in 1911, the crop in that year having suffered too much damage from storms.

(1) In 1908 only the culms were examined, 825 in number.



TABLE I. — Correlations between "average length of a plant" and "grain yield per plant" observed in 1909.

Grain yield per plant

	0-1 gr	1-2 gr	2-3 gr	3-4 gr	4-5 gr	5-6 gr	6-7 gr	7-8 gr	8-9 gr	9-10 gr	10 to 11 gr	11 to 12 gr	12 to 13 gr	13 to 14 gr	Total number of plants
40-45 cm	1														1
45-50 cm	2	1													3
50-55 cm	5	3													8
55-60 cm	1	6	4												11
60-65 cm	7	19	9					1							36
65-70 cm	3	18	26	12	1										60
70-75 cm	4	10	42	20	10	3	2	1		1	1				94
75-80 cm	2	4	14	38	23	6	5	5						2	99
80-85 cm			1	22	32	19	11	10	5			1	1		102
85-90 cm		1		4	13	17	17	9	4	1	2				68
90-95 cm					2	2	5	5	1		2	1			18
Total number of plants . . .	25	62	96	96	81	47	40	31	10	2	5	2	1	2	500

Height of plants

TABLE II. — Correlations between "average height of a plant" and "average weight of a grain observed in 1910.

Average weight of a grain

	115 to 125 mg	125 to 135 mg	135 to 145 mg	145 to 155 mg	155 to 165 mg	165 to 175 mg	175 to 185 mg	185 to 195 mg	195 to 205 mg	205 to 215 mg	215 to 225 mg	225 to 235 mg	235 to 245 mg	Total number of plants
45-50 cm							1	1						2
50-55 cm		1	2	1	1	3			1					9
55-60 cm			1	1	3	7	4	2	1	1				21
60-65 cm		1	1	3	7	8	10	2		1	1			34
65-70 cm		1	5	13	13	24	23	9	5	2	1	1		97
70-75 cm		1	3	12	31	30	24	11	5	5	1			123
75-80 cm	1		3	16	14	25	13	10	6	1				89
80-85 cm			1	4	3	6	7	2	1					24
85-90 cm														0
90-95 cm							1							1
Total number of plants	1	4	16	50	72	103	83	37	19	10	4	0	1	400

Average heights of plants



Among biometrical data determination was made of the following values :

- 1) *Number of stems per plant*
- 2) *Average height of a plant* (sum of the lengths in cm. of all the culms, from the surface of the soil to the base of the apical spikelet, divided by the number of culms of a single plant).
- 3) *Total yield of grain per plant* (total weight of grains expressed in grams).
- 4) *Average yield of grain per culm* (total yield of a plant divided by the number of culms).
- 5) *Total number of grains per plant.*
- 6) *Average number of grains per culm* (total number of grains of a plant divided by the number of culms).
- 7) *Average weight of a grain per plant* (total weight of the grains divided by their total number ; quotient expressed in milligrams).
- 8) *Total number of spikelets per plant.*
- 9) *Total number of spikelets per stem* (total number of spikelets on a plant divided by the number of stems).
- 10) *Average number of grains per spikelet in a plant* (total number of grains of a plant divided by the number of spikelets).

#### I. CORRELATIONS BETWEEN THE " AVERAGE LENGTH OF A PLANT " AND THE REMAINING CHARACTERS.

1) *Correlation with " total grain yield per plant. "* — This is illustrated by Table I, in which are arranged the data obtained in 1909. In this double entry Table the " average lengths " every 5 cm., starting with 40 cm., are arranged as ordinates, in the first column on the left, outside the frame. The " grain yields per plant " in grams, are arranged as abscissae above the frame. Within the frame are inscribed the numbers of plants which show in each case such or such combination of " average length " and " grain yield. " For example, the number 11 placed in the 7th column from the left, 9th line, shows that, among 500 plants examined, 11 have an average length of between 80 and 85 cm., and a grain yield of between 6 and 7 gr. Outside the frame, below and to the right, are placed the respective totals of plants for each category of length and of yield ; in the south-east angle is placed the total number of plants examined : 500. — Tables II and III show a similar arrangement. Table I shows a very distinct correlation between " average length of a plant " and " total grain yield of a plant. " The coefficient of correlation is  $0.689 \pm 0.016$  in 1909. In 1910 and 1912, a similar correlation was observed but, in this case it was less distinct.

2) *Correlation with " average grain yield per culm. "* — The foregoing is positive for the 3 years under observation with a maximum coefficient of  $0.850 \pm 0.008$  in 1909. The minimum weight of grains per culm : 0.1-0.2 gr. was observed in a single plant, 40-45 cm. in height ; the maximum weight ; 1.8 - 1.9 gr. also in a single plant, 85-90 cm. in height. Between these

limits, there is a more or less regular relationship between increase in length of stem and increase of weight of grains per stem.

3) *Correlation with "total number of grains per plant."* — This varies from  $0.487 \pm 0.026$  in 1910 to  $0.676 \pm 0.016$  in 1909.

4) *Correlation with "average number of grains per plant."* — Varies from  $0.658 \pm 0.013$  in 1908 to  $0.835 \pm 0.009$  in 1909.

Thus in the two cases 3) and 4) there is a high degree of distinct and stable correlation. As the height increases the average number of grains increases with it, whether per plant or per culm.

5) *Correlation with "average weight of a grain per plant."* — This is illustrated by Table II containing the data for 1910. The coefficient varies from  $-0.023 \pm 0.034$  in 1910 to  $0.555 \pm 0.016$  in 1908, i. e. from complete absence to a high degree of correlation. The ratio between "average height of a plant" and "average weight of a grain" may be either very narrow, or in some cases on the other hand may be modified in such a way that the two characters may be perfectly independent of one another. This is what was observed in 1910: e. g. to the weight 18.8 - 19.5 mg. there correspond heights varying from 45-50 cm. to 80-85 cm.; conversely, to a height of 65-70 cm., for example, there correspond weights varying from 12.5 - 13.5 mg. to 23.5 - 24.5 mg.

6) *Correlation with "number of culms per plant."* — Varies similarly to the preceding, the coefficient of variation being comprised between  $0.042 \pm 0.034$  and  $0.523 \pm 0.024$ .

7) *Correlation with "number of spikelets per culm."* — This, on the contrary, is stable and gives a high coefficient comprised between  $0.699 \pm 0.012$  and  $0.817 \pm 0.010$  in 1909.

## II — CORRELATIONS BETWEEN "TOTAL GRAIN YIELD PER PLANT" AND THE REMAINING CHARACTERS.

1) *Correlation with "average yield per culm"*. — This correlation is a very distinct and stable one, the coefficient being comprised between the narrow limits  $0.692 \pm 0.018$  and  $0.761 \pm 0.013$  in 1909, but owing to the uneven mode of growth in the oat plant the correlation is not perfect: some stems develop to a greater extent than others, in such a way that the plants with numerous stalks often give a relatively low yield per stalk.

2) *Correlation with "total number of grains per plant."* — Distinctly positive: the coefficient varies from  $0.918 \pm 0.005$  in 1910 to  $0.098 \pm 0.001$  in 1912. The plants with yields of 1-2; 11-12; 19-10 gr. bear 100-150, 60-800; 1200-1300 grains respectively.

3) *Correlation with "average number of grains per plant."* — Similar to the preceding though perhaps somewhat less distinct.

4) *Correlation with "average weight of a grain per plant."* — This is very variable and always somewhat low, as shown by the coefficients  $0.035 \pm 0.034$  in 1910 and  $0.220 \pm 0.032$  in 1912. Good and bad bearing plants often carry grains of equal average weight: thus grains weighing



16.5 - 17.5 mg. are found throughout a whole series of plants the yield of which varies from 0-1 to 6-7 gr.

5) *Correlation with "number of spikelets per culm."* — Positive and high. The greater the number of spikelets per culm the higher the grain yield.

6) *Correlation with "number of culms per plant."* — Positive, the coefficient varying from  $0.712 \pm 0.017$  in 1910 to  $0.912 \pm 0.006$  in 1912.

### III. CORRELATION BETWEEN "AVERAGE WEIGHT OF A GRAIN PER PLANT" AND THE REMAINING CHARACTERS.

1) *Correlation between "average weight of a grain per plant" and "average weight of a grain per culm."* — This is very low and varies considerably from year to year: from  $0.225 \pm 0.032$  in 1910 to  $0.464 \pm 0.018$  in 1908. Nevertheless it is always superior to the correlation between "average weight of a grain per plant" and "total yield per plant."

2) *Correlation with "total number of grains per plant."* — The coefficient varies from  $-0.253 \pm 0.032$  in 1910 to  $0.071 \pm 0.034$  in 1912.

3) *Correlation with "total number of grains per culm."* — The coefficient varies from  $-0.172 \pm 0.033$  in 1910 to  $0.300 \pm 0.021$  in 1908.

These correlations 2) and 3) vary considerably from year to year, while remaining, on the whole, very low, to the extent of being occasionally negative. The number and weight of the grains may increase without being accompanied by corresponding modifications of the other characters.

4) *Correlations with "average number of spikelets per culm" — "average number of grains per spikelet" — "number of culms per plant."* — Very variable and subject to fluctuation.

### IV. CORRELATIONS BETWEEN "AVERAGE NUMBER OF SPIKELETS PER CULM" AND THE REMAINING CHARACTERS.

1) *Correlation with "average number of grains per spikelet."* — Positive: the coefficient varies from  $0.253 \pm 0.032$  in 1910 to  $0.324 \pm 0.027$  in 1909.

2) *Correlation with total number of spikelets per culm."* — Still narrower: in 1908 the coefficient is  $0.880 \pm 0.005$ . The data obtained in that year are arranged in Table III.

### V. — CORRELATION BETWEEN THE "NUMBER OF CULMS PER PLANT" AND THE REMAINING CHARACTERS.

1) In a particularly favourable environment, the increase in the number of culms is accompanied by a corresponding increase in: the height of the plants — the average grain yield per culm — the average number of grains per culm. But these correlations are always rather low, fluctuating and may sometimes disappear completely.

2) The increase in the number of stems is also accompanied by an increase in the total grain yield per plant.

3) The "number of stems" and "the average weight of a grain" vary independently of each other.

### CONCLUSIONS.

It results from the foregoing that certain characters may furnish a good basis for the work of selection.

TABLE III. — *Correlations between "average number of spikelets per culm" and total number of grains per culm", observed in 1908.*

*Total number of grains per culm.*

	<i>Total number of grains per culm.</i>										<i>Totals of culms</i>
	1-10	10 to 20	20 to 30	30 to 40	40 to 50	50 to 60	60 to 70	70 to 80	80 to 90	90 to 100	
1-5	33										33
5-10	63	123									186
10-15	7	120	87	1							215
15-20	2	17	132	36							187
20-25	1	7	18	78	14	5					123
25-30		1	1	17	29	6	1	1			56
30-35					3	6	4	1			14
35-40						1	2	1	3		7
40-45								2		1	3
45-50										1	1
<i>Totals of culms</i>	106	268	238	132	46	18	7	5	3	2	825

1) The variable nature of the meteorological factors influences the biometrical values, producing more or less marked oscillations about the mean values. The conditions which bring about a reduction in the grain yield also determine a diminution in: the height of the plants - the number of grains — the number of stems — and increase in the size of the grains.

2) Decrease in the number of grains has greater influence on the yield than decrease in size of the grains.



3) Decrease in the values and mean coefficients is accompanied by decrease in the variability.

4) The correlations are classed as "fluctuating" or "stable" according to their greater or less degree of sensitiveness to external factors

5) For example, high, positive and stable correlations are observed between the "average height of a plant" and: a) "total and average yields;" b) "total and average number of grains;" c) "average number of spikelets per culm." On the other hand, fluctuating correlations occur, high in some cases, very low in others, between "average length of a plant" and: a) "average weight of a grain;" b) "number of culms."

6) The "total grain yield per plant" is in close correlation with: a) "yield per culm;" b) "total and average number of grains;" c) "number of spikelets;" d) "number of culms."

7) The "average weight of a grain" is only correlated to "average yield per culm" and to no other character.

8) The "average number of spikelets" per culm is in close correlation with: a) "average number of grains per spikelet;" b) "number of grains per culm;" c) "average height of a plant;" d) "yield of a plant."

a) As regards correlations between "number of culms per plant" and other characters, the following observations have been made:

With: a) "average height of a plant;" b) "average yield per culm;"

c) "number of grains," fluctuating and variable correlations.

With "total yield of a plant," stable and positive correlation.

With "average weight of a grain" a correlation usually positive but always very low.

In short, in order to increase the yield of oats, preference should be given to those plants which are tallest and bear numerous spikelets each of which is well provided with grain. There is no need, however, to attach much importance to the size of the grains as these latter often given high values even on small, poorly productive plants.

27 - **Correlative Characters of the Rice Plant.** — JACOBSON H. O. (Chief, Plant Industry Division), in *The Philippine Agricultural Review*, Vol. IX, No. 2, pp. 79-119. Manila 1916.

The results of numerous researches made by the writer in the Philippines from 1909 to 1913, on the correlations existing between the anatomical and physiological characters of rice, the duration of the growth period and the yield of grain.

*Average duration of growth period (from sowing to complete maturity of the grain) and the yield of paddy.* — Table I gives the most important data regarding this subject.

When the growth period is not less than 120 days, or longer than 180, it has no appreciable effect upon the yield. On the other hand, great precocity is nearly always accompanied by a decrease in the yield, as can be seen from the many experiments carried out with varieties of both lowland and upland rice which mature in less than 120 days (minimum 100 days), but always have a much lower yield than other varieties with a growth period lasting from 30 to 45 days longer. Equally unsatisfactory results are obtained from varieties that ripen very late, since the time of maturity

TABLE I. — *Correlation of duration of growth period and yield of paddy.*

Occurrences	Duration of growth period	Average yield of paddy per hectare
5	114 days	829 kg.
16	124.8	1 849
88	135	1 715
133	144.8	1 903
129	154	1 748
133	169	1 966
166	174.3	1 995
163	184.5	1 846
89	193.5	1 376
87	210.2	1 024

often coincides with unfavourable weather conditions and opportunity is afforded to diseases and pests to injure the plants and thus lower the yield of grain.

*Tillering and yield of paddy.* — As the number of culms per plant increases, the yield also increases. The true significance and value of the tillering character is not yet fully realised, but it may be regarded as very desirable. Scanty tillering may be remedied by very thick planting. Table II gives a summary of the correlation observed between tillering and yield of paddy.

TABLE II. — *Correlation of tillering and yield of paddy.*

Occurrences	Average of culms per plant	Average yield of paddy per hectare
3	2.7	561 kg.
44	3.6	1 007
208	4.4	1 342
283	5.4	1 776
249	6.4	1 889
137	7.4	2 201
38	8.3	2 415
10	9.4	2 521
6	10.4	2 214
1	11.9	2 797
1	12.6	2 373

In these calculations, it must never be forgotten that tillering, the number of grains per panicle, and grain or seed size, are elastic or compensating characters, thus a large number of seeds per panicle may correspond to a small number of culms; on the other hand, a small number of grains per panicle may be counter-balanced by the better development of each grain due to different organic requirements, or to the meteorological conditions obtaining during the various phases of growth.

*Length of culm and yield of paddy.* — Table III summarises the most important data on this subject.

TABLE III — *Correlation of culm length and yield of paddy.*

Occurrences	Average length of culms	Yield of paddy per hectare
41	1 058 mm.	1 150
45	1 143	1 268
101	1 257	1 423
183	1 350	1 560
163	1 445	1 652
169	1 548	2 060
133	1 648	1 841
86	1 747	2 018
50	1 840	2 296
13	1 944	2 025
2	2 066	1 750

Within certain limits, at least, the increase in the culm length is associated with greater productivity. In selection work, it is advisable to take 1.5 m. as the standard culm length; by selecting short-stemmed varieties, plants of low yielding capacity are obtained. Further it is not the fact that varieties with short culms resist lodging best, for the ability of a plant to withstand high winds depends upon the culm structure and root distribution. In the case of all varieties, but especially in that of the taller kinds, the culm length varies from one year to another according to the season, but when the deviations from the average are very great in either direction a perceptible loss in yield results.

*The number and shape of the grains and the length of the growth period.* The shape and the number of grains in the panicle have little effect upon the yield. Varieties with 100 grains per panicle can produce as large a crop as those with 300 grains per panicle. Varieties having long, slender grains may give as high a yield as those bearing short plump grains. On the other hand, grain length has a positive correlation to the maturing period, the



longer the grain, the more time the variety requires to ripen. This is shown in Table IV.

TABLE IV. *Correlation of grain length and duration of growth period.*

Occurrences	Average length of grain	Duration of growth period
16	6.6 mm.	152.6
221	7.5	161.6
324	8.4	164.9
182	9.3	169.6
55	10.3	173.3
6	11.2	179.8

A negative relation exists between the width of the grain and the duration of growth period, as is shown in Table V.

TABLE V — *Correlation of grain width and length of growth period.*

Occurrences	Average width of grain	Average duration of growth period
23	2.35 mm.	172.9 days
212	2.76	169.8
455	3.20	167.5
102	3.66	157.6
12	4.16	145.8
4	4.57	140.0

But since the amount of time required to attain maturity, if within the limits indicated above, does not have any marked influence on the yield of grain, the principal interest in this character is with regard to selecting a variety which is most adapted to the average rainfall conditions in the district in which it is to be cultivated.

*Number of grains per panicle and length of growth period.* — The larger the number of grains per panicle, the longer the growth period, as is shown in Table VI.

TABLE VI. — *Correlation of grains per panicle and duration of growth period.*

Occurrences	Average number of grains per panicle	Average duration of growth period
7	92.8	142.4 days
83	132.8	155.9
240	173.9	161.7
215	240.0	169.2
129	280.5	168.2
60	319.8	173.6
16	359.1	187.6

*Length of culm and duration of growth period.* — When the culm length is from 1 to 1.5 m. there is no correlation between this value and the duration of the growth period. On the other hand, beyond this limit, there is direct correlation; the longer the culms the more protracted is the growth period and *vice versa*. For 167 varieties having a culm length of 1.5 m., the mean growth period was 164.6 days, while 84 varieties with a culm length of 1.7 metres required 172.4 days. One hundred varieties with a mean culm length of 1.2 metres required 157.7 days to reach complete maturity.

TABLE VII. — *Correlation of length of culm and duration of growth period.*

Occurrences	Average length of culm	Average duration of growth period
41	1 508 mm.	157.0 days
45	1 143	153.8
101	1 257	160.1
183	1 350	163.8
163	1 445	164.8
169	1 548	170.7
133	1 648	177.0
86	1 746	174.7
50	1 840	172.4
13	1 944	187.3
2	2 067	161.5

*Length of culm and length of rachis.* There is direct correlation between these two values as is shown by Table VIII.

TABLE VIII. — *Correlation of length of culm and length of rachis.*

Occurrences	Average length of culm	Average length of rachis
17	930 mm.	181 mm.
289	1 298	230
472	1 488	271
188	1 668	320
13	2 139	360

*Length and diameter of culm.* — As a rule, the longer the culm, the greater its diameter, as is seen in Table IX.

TABLE IX. — *Correlation of length and diameter of culm.*

Occurrences	Length of culm	Mean diameter
46	1 240 mm.	4.6 mm.
228	1 346	5.5
405	1 471	6.4
234	1 545	7.3
28	1 412	8.2
5	1 894	9.4

*The number of nodes and the duration of the growth period.* — While the length of the culms varies considerably according to the growth conditions prevailing, the number of nodes is quite constant for a given variety. Varieties which have many nodes tend to mature later than those with a smaller number, as is shown by the data given in Table X.

A slight positive correlation exists between the length of the grain and that of the culm, and between the length of the rachis and the number of its ramifications, while there is a negative correlation between the number of nodes and the length of the internodes.

Although the writer has only examined the varieties of rice cultivated in the Philippines, the number of data collected, and the exactitude of the



TABLE X. — Correlation of number of nodes and duration of growth period.

Occurrences	Average number of nodes per culm	Average duration of growth period
2	3.7	114.0 days
16	4.6	147.7
375	5.5	152.6
427	6.3	173.6
148	7.3	188.9
6	8.2	207.5

methods employed in the work, render his conclusions extremely interesting to those engaged in the selection and improvement of this important plant. In the best individuals, the development of the various organs shows average values, avoiding extremes such as great length or shortness of culm; too great precocity, or the reverse; these extremes being often accompanied by low yield, as has already been observed in the case of maize, barley and oats. However, after having eliminated the plants possessing characters correlated with a small grain yield, the plant breeder should, when isolating the most suitable types, give the preference to those of which the positive characters oscillate around the average value, rather than seek for exaggerated forms and characters which are nearly always associated with a deficiency in organic equilibrium, and consequently with a decrease in yield.

28 — Correlation between the External and Internal Morphology and the Length of the Vegetative Period of some Varieties of *Trifolium pratense*; Research-work in Russia. — Жолітєвичъ Б. (JOLTEVITCH V.), in *Журналъ Опытной Агрономіи имени П. С. Коссовича*. (Review of Experimental Agricultural Science dedicated to the memory of P. S. KOSSOVITCH. Vol. XVII, Part 3, pp. 239-248. Petrograd, 1916.

Researches carried out part at a farm in the province of Orel, part at the agricultural laboratory of the University of Kiev. The observations were made in 1912 and 1914.

In the first year, 5 clovers from different localities were tested: 1) Podolia clover; 2) Orel clover; 3) improved Orel or Stroukovsk; 4) *Trifolium pratense foliosum*; 5) Perm clover. These varieties all had a different flowering time, and from this point of view could be divided into two groups: 1) *early clovers*, including the first three varieties; 2) *late clovers*, including the two latter varieties.

In 1912, the Podolia clover began flowering on June 12, and the Orel and Stroukovsk 5 to 6 days later. The two late varieties, *T. pratense foliosum* and Perm clover only commenced flowering on July 1. Thus the difference in time of flowering between the early and late varieties is a maximum of about 3 weeks.

Internal Morphological Characters										External Morphological Characters						
Varieties	Year 1912					Year 1914					Year 1912				Year 1914	
	Diam-eter of cells of palisade paren-chyma	Length of the stomates	Number of stomates visible in micro-scope field	Number of epi-dermal cells visible in micro-scope field	Diam-eter of the cells of the palisade paren-chyma	Length of the stomates	Number of stomates visible in micro-scope field	Biennial clover				Trien-nal clover	Num-ber of inter-nodes per stem.	Average super-ficial area of a leaf		
								Average length of a stem.	Number of flower heads per stem.	Number of inter-nodes per stem.	Number of inter-nodes per stem.					
Podolia Clover. . . . .	18.4 $\mu$	19.7 $\mu$	17.8	51	16.8 $\mu$	19.7 $\mu$	16.5	54.2 cm.	1.8	2.7	7.4	7.7	6.4	146 Sq. cm.		
Orel Clover . . . . .	—	19.7 $\mu$	15.9	52	—	—	—	53.5 cm.	2.1	3.4	7.8	—	—	—		
Stroukovsk clover . . . . .	—	18.9 $\mu$	18.0	51	—	—	—	—	2.8	3.8	8.0	—	—	—		
<i>Trifolium pratense foliosum</i> . . . . .	—	—	—	—	13.3 $\mu$	18.6 $\mu$	18.3	—	—	—	—	—	8.1	22.3 Sq. cm.		
Perm Clover. . . . .	16.9 $\mu$	17.5 $\mu$	22.9	71.2	—	—	—	60.1 cm.	3.3	4.7	9.5	8.8	—	—		

In the second year, two varieties were studied, *Podolia* clover and *Trifolium pratense foliosum*; they began flowering respectively on May 27 and June 14.

In all the above varieties, the following morphological characters were studied:

INTERNAL MORPHOLOGICAL CHARACTERS (on 30 leaves per variety):

Diameter of the cells of the palisade parenchyma (40 measurements per leaf).

Length of the stomata (20 measurements per leaf). Number of epidermal stomata visible in the field of the microscope (10 counts per leaf).

Number of epidermal cells visible in the field of the microscope (5 counts per leaf).

EXTERNAL MORPHOLOGICAL CHARACTERS (on 65 plants per variety):

Length of the stem.

Number of internodes per stem.

Number of branches per stem.

Number of inflorescences (heads) per stem.

Average area of a leaf.

All these characters are summarised in the table on page 67. As regards the *internal morphological characters*, the table shows that:

In the early varieties of clover, the length of the stomates and the diameter of the cells of the palisade parenchyma are greater than in the late varieties.

As the length of the stomates diminishes, so does their number increase per unit of area, as also do the number of epidermal cells.

As regards the *external morphological characters* it is seen that the late varieties have: a longer stem — more internodes — a more marked tendency to branch — a greater number of flower heads per stem.

*Correlation between the number of internodes and the times of flowering.*

— The author quotes from Russian work done on this subject:

With regard to the varieties of *Alectorolophus* (= *Rhinanthus*) *major*, N. V. ZINGHER (1) wrote: "These varieties, flowering at different periods, differ from one another not only biologically, but also morphologically. The relatively late flowering variety, suitable for cutting at the end of July, is distinguished from the spring-flowering variety cut in June by: double the number of internodes and a more marked tendency to branch" The same author writes, regarding 5 closely related varieties of this plant: "A close comparison of these different varieties at flowering leads to the conclusion that all the differences between their vegetative organs can be reduced to a difference between the number of internodes per stem and in the rapidity of development of the chief stem. A close relation has been established between the number of internodes and the length of development of the variety: the longer the development, the later is flowering and the larger the number of internodes of the principal stem; the rapidity of development of the stem is closely connected with the time required for development". On the other hand, V. N. KHRITROV, in his *Critical Notes on*

(1) Cf. Bulletin of the Tiflis Botanical Garden Vol. XII. Part 2.

(Ed.).



the genus *Geum* and its hybrids in the province of Orel, says: "We are certain of the following facts:

"1) The number of internodes is sufficiently constant for each species.

"2) It is the most evident external sign of a given period of flowering.

"3) The number of internodes is also connected with certain other external characteristics of the stem.

"The selection of plants: 1) "of early flowering"; 2) "of late flowering", is the same as the selection of plants: 1) "of a limited type of structure"; 2) "of a numerous type of structure" with an exact agreement with the terms of comparison. In other words, within the limits of a series of related forms, a fixed unity of time, that is, the unit of the vegetative period, corresponds with the development of each structural unit of the plant in space". This author further writes: "we can thus indicate an external character useful for selecting in order to obtain a variety of a certain type of flowering" (1).

JOLTKEWITCH says that his researches show the existence of a correlation between the two classes of characters: structure of the stem and dimensions of the cells. He has also measured the length of the corolla tube in these varieties and has found that it is less in the late varieties than in the early ones.

In grouping the information on the internal morphology (see Table) according to the 3 most common colours of the corolla: red, pink, white, he found that in the Perm variety the non-red flowers form 10 % of the total, while in all the other varieties, they form 50 %; on the other hand, in the varieties with white flowers, the stomata are smaller than in the plants with red flowers.

(1) САЦПЕРОВЪ Ф. А. (F. A. SAZYPEROV), in *Трубя Бюро по прикладной Ботаникѣ* (Bulletin of applied Botany), No. 12 (76), p. 231, Petrograd, December 1914, has published notes completing the Russian translation of FRUWIRTH's work on the selection of agricultural plants. With regard to clover selection in Russia, he says: There are two forms of this clover in Russia: late Orel clover, grown chiefly in the provinces of Orel and Toula; Southern early clover, grown in south west Russia. These forms were studied for 3 years in the United States, and their position decided. The first form was described by BRAND as a new variety: *Trifolium pratense foliosum* Brand. It is distinguished from the southern form by later flowering, taller growth, and greater development of the vegetative organs, greater productivity, smaller and less coloured seeds and is more lasting. These researches drew attention to the forms in Russia. It was found that, owing to not distinguishing these two forms, Orel clover has been replaced by the southern clover in the regions where it was originally more common (provinces of Orel, Moscow and Livonia).

V. B. KHITROVO showed that lateness in the Orel clover is related to the "greater number of internodes of the flowering stem, and this is why he advises the use of this character as a guide to selection".

In addition, the Author mentions the selection work carried out by the Selection Stations of Moscow and Kharkov and by the Agricultural Experiment Station of Chatilovskaia (province of Toula).

(Ed.)

## CEREALS

- 29 - **Experimental Work in Egypt on Various Cereals.** — I. DUDGEON G. C. and BOLLAND G., Work on Egyptian Wheats, in *Egyptian Ministry of Agriculture, Technical and Scientific Bulletin*, No. 7, 9. pp. Cairo, 1916. — II. HUGHES F., Tests of Flour made from Egyptian Wheats, *Idem.*, No. 10, 12, pp. illus. — III. BOLLAND B. G. C., Work on Great Millet (*Sorghum vulgare*) and Bersim. (*Trifolium alexandrinum*) (1), *Idem.*, No. 8, 8, pp. — IV. DUDGEON G. C. and BOLLAND B. G. C., Work on Egyptian Maize, *Idem.*, No. IX, 8, pp.

I — *Work on Egyptian Wheats in 1915.* — Experiments on the amount of seed to sow, the yield of different varieties, and seed treatment for "smut". It was found that sowing at the usual rate of 6 "kelas" (2.72 bushels) per "feddan" (1.038 acres) gave the highest yield and that harrowing in the seed gave a better result than ploughing in. The four varieties tested for yield gave results (in order of merit) as follows :

1) Variety White <i>Baladi</i> . . .	yield	61.46 bushels per acre.
2) " <i>Hindi</i> . . . . .	"	56.96 " " "
3) " Red <i>Baladi</i> . . . .	"	56.91 " " "
4) " Muzaffarnagar . . .	"	56.54 " " "

Copper sulphate at strengths from 0.5 to 10 per cent strength and Cyllin at 1 in 100 to 1 in 250 strength were used to treat the seed for smut. The results indicate that the copper sulphate solution should not be used more concentrated than in 2 per cent solution, which gave the best result. The Cyllin and the copper sulphate, if used too strong, reduce the germinating capacity. The Cyllin solutions were all found to be too strong, though successful in preventing smut.

II. *Tests of Flour made from Egyptian Wheats* : Proceeding from the definition by HUMPHRIES and BIFFEN of strength "as the capacity of a flour to yield large well-piled loaves", it was endeavoured to ascertain the strength of the flour by measurement of the gas evolved on fermenting the flour with yeast. To avoid variations in the quality of the yeast, a number of tests were made simultaneously, the gas being measured by displacing water. Table I shows results obtained by this method.

It should be noticed that all the samples of Indian wheat examined gave a small volume of gas, and should, according to this test, be classed as "weak" wheats. *Saidi* wheat, again, appears to be "strong" During these experiments, it was found that uniformity of grinding was most essential; unevenly ground samples gave a much poorer yield of gas than when finely ground. Another set of tests in relation to manuring showed that potash and phosphatic manures gave most marked effects on the gas production. This bears out the result of the Experiments of the Royal Agricultural Society at Woburn, where it was found that mineral manures *i. e.* potash salts and phosphates, usually give a stronger wheat than that given by nitrogenous manures alone.

In any case, the gas tests require to be supplemented by actual trials of baking bread.

III. *Work on Millet (Sorghum vulgare) in 1915.* — An attempt to

TABLE I.

Variety	Where ground	Moisture per cent	Nitro- gen per cent	Bran per cent	Weight of 1000 seeds in gr.	Gas evolved from 20 gr. flour, in cc.
<i>Hindi</i> from Egyptian seed	—	11.42	1.65	10.5	44.6	259
<i>Hindi</i> from Indian seed	—	10.46	1.52	9.8	42.7	260
Red <i>Baladi</i> . . . . .	—	11.04	1.48	8.9	46.3	365
White <i>Baladi</i> . . . . .	—	10.36	1.98	10.8	50.8	451
<i>Gawi</i> . . . . .	Assiut	9.36	2.14	9.3	51.0	504
<i>Hindi</i> . . . . .	—	11.14	1.62	10.3	38.0	280
White <i>Sa'idi</i> . . . . .	—	10.02	1.60	10.6	45.2	520
<i>Sa'idi</i> F. A. Q. . . . .	—	9.86	1.64	10.6	57.2	570
<i>Fayûmi</i> . . . . .	—	10.06	1.55	9.4	—	470
<i>Beheiri</i> . . . . .	—	10.74	1.50	9.6	40.5	495
<i>Hindi</i> . . . . .	Beni Suef, Basin. . .	9.58	1.65	10.3	36.1	264
<i>Hindi</i> . . . . .	Beni Suef, Canal . .	9.66	1.50	9.6	40.5	250
<i>Hindi</i> . . . . .	Imported choice white	10.00	1.60	—	—	265

separate from among the common names given to millet in Egypt the separate varieties and to describe them; also to improve the yield and quality of the crop by selection and isolation of pure varieties. The different kinds were found to be so mixed that no accurate description was made, and further, in different localities different names are given to the same variety. Small samples of 24 distinct varieties of millet were obtained from the Sudan and grown at Giza, but no comparisons of yield were made, the samples being too small. The 24 varieties are described in tabular form. The work is being continued.

IV. *Work on Egyptian Maize in 1915.* — The growth of maize (*Zea mays*) is well suited to Egypt and is gradually replacing millet over large areas. The varieties are all mixed and grown together so that selection and breeding work has been started in order to improve the crop and to obtain pure varieties. The work is still in progress.

30 - **Wheat-land in the Republic of San Salvador, Central America.** — *Centro America, Organo de Publicidad de la Oficina Internacional Centro-Americana*, Vol. VIII, No. 3, pp. 439 — 440. Ciudad de Guatemala, July-September, 1916.

According to information collected by DR A. HERNANDEZ, there are, in the Republic of San Salvador, 224 *caballerias* (about 10 000 hectares) of land devoted to wheat growing and spread in nearly all the departments. Such an area cultivated under modern methods, could produce 220 000 hectolitres of corn, or 130 000 quintals of flour, an amount larger than that imported. The country has thus the possibility of supplying its own wants.



Besides, the presence of abandoned mills show that wheat was formerly grown.

In the department of Santa Ana, an area of 25 *caballerías* (1 125 hectares) is suitable for wheat-growing. The neighbourhood of the town of that name is very fertile, and produces with little labour and no manuring, fine crops of beans, maize, wheat and other cereals.

In the cantons of Rosario (district of Metapan), San Miguel, El Brujo and San José, there are farms growing sugarcane and wheat at the same time, or coffee, sugarcane and wheat, and which also have a flour-mill. In 1914, Apaneca (department of Ahnchapán) produced 58 quintals of wheat; Ataco, the same amount; Jujutta, 69 quintals; Atquizaya, 11 quintals.

In the Sonsonate zone, where the mean annual temperature is from 20 to 22° C., wheat is grown on a large scale (by the side of the sugar cane, coffee, and maize). The cold and well wooded land in the north (oaks and pines) where the mean average temperature is about 16° C, produces very good wheat and other cereals. In the north of Yuayúa, there are several districts suited for wheat-growing. In the district round the capital, the zones of El Paisnal and Guazapa should be mentioned as wheat land.

The best and most extensive wheat land is to be found in the department of Chalatenango. Intensive wheat growing is carried on at San Ignacio, where not less than 69000 quintals of grain are produced annually. Wheat is regularly grown in the valley of San José del Sacare (near La Palma), in the neighbourhood of Los Planes and La Granadilla. All these cantons have mills. Other districts having excellent wheat land are: Citalà — La Reina — San Fernando — Dulce Nombre de Maria — San Francisco — Morazan — La Laguna — Carrizal — Ojos de Agua — Comalapa — Quezaltepeque — Estanzuelas — Perquicu — Yámabal — and also the departments of Tecapán, Morazan, etc.

The elevated region of the department of La Paz is well suited to the growth of wheat among other crops. Round Alegría and on the plain of Quemela, wheat succeeds extremely well, as the farmers have found by experimenting. The products for home consumption grown by the small growers in the district round Santiago also include wheat.

31 — **The Cultivation of the "Broom Sorghum" in Tunis.** — *Bulletin mensuel de l'Office du Gouvernement Tunisien*, Year 10, No. 91, pp. 70-71. Paris, September-October 1916.

In Tunis the cultivation of sorghum is not much developed; nevertheless the planters and natives of the rainy regions in the north of the Regency devote a certain area to its cultivation. White sorghum, which gives a very white and nourishing flour, is the most widely grown variety. The cultivation of Broom Sorghum (or red sorghum) has been tried at Tabarka, Nefzas, Hedills and Mateur. (Trials have also been made on several occasions in various parts of Algeria, especially in the Philippeville district). A workshop for making brooms has even been established in Mateur, in the hope of founding a Tunisian industry, but without obtaining the desired results. This idea has now been revived by the Economic Department of the Tunisian Government, which has just established a little broom manufactory.

The variety grown in Tunis that gives good products is the half-red broom sorghum from Provence.

The seed is drilled on well, freshly cultivated ground from April 15 to May 15 at the latest, in lines about 2 ft. 6 ins. apart and with 1 ft. to 1 ft. 3 ins. between the plants. The yield per acre is 10 to 12 cwt. of straw and, theoretically, 24 cwt. of seed, but in practice much less is obtained because of the sparrows which take the grain and are most difficult to control.

In growing broom sorghum, as with the other sorghums, the grower is confronted with a degeneration of type which makes it necessary to renew the seed every year. This variation is attributed to crosses with the "bechna" and Alep sorghum.

France grows little broom sorghum, as it has only been known there for some sixty years; it is grown most in Vaucluse and a little in Bordelais, but even then it is most often grown round the edges of the fields.

The sorghum straw used in France comes almost exclusively from Italy. The principal importers are in Vaucluse, especially at Orange and Caderousse. Broom manufacturers are found all over France, being, however, more numerous in the North than in the South. By having return cargoes, Tunis could supply the northern manufactures directly, as they buy supplies at Orange.

The straw is of two kinds, large and small. The small is much cheaper and is used to fill out the interior of the brooms. The large is used for the covering and fetched prices of recent years of from 10 to 16 s. per cwt.; at present it is worth 26 s.

Tunis could produce straw of finest quality able to bear comparison with the best Italian straw. Tunis even has the advantage of being able to dry the straw in the open air without a shed, as summer rains are usually very rare.

**32 - Commercial Varieties of Lucerne in the United States.** — OAKLEY R. A. and WESTOVER H. L., in *United States Department of Agriculture, Farmer's Bulletin* 757, 24 pp., 7 fig. Washington, October. 12 1916.

FORAGE CROPS,  
MEADOWS  
AND PASTURES

At the present day 9 distinct commercial varieties of lucerne are recognised in the United States, varying in their adaptability to different climatic conditions. Some give the best results in the North and North West States, while others are only successful in the South and South West, where the winters are mild.

Under the term "common alfalfa" are included all lucernes which are not of quite distinct hybrid origin or which do not possess the characteristics of distinct and uniform varieties *e. g.* the "Peruvian" and "Arab" varieties. The "common alfalfa" group contains a large number of strains. They are often known by the name of the locality where they are cultivated, *e. g.* "Kansas grown alfalfa", "Montana grown alfalfa", and several others. Occasionally they are known by a term describing the conditions under which they are grown, *e. g.* "dry land alfalfa", "irrigated alfalfa", "unirrigated alfalfa" etc.

The strains from the Southern portion of the United States usually give higher yields than those from the North, but they are less hardy.



Hitherto, seed from "dry land alfalfa" tendered on the market has not shown any appreciable superiority over ordinary alfalfa in respect of resistance to drought.

A large number of experiments have been made throughout the United States with commercial lucerne from Turkestan. In almost every case it has proved inferior to the home product.

Definite determination has also been made of the adaptability of different varieties and strains of lucerne to varying conditions.

The principal commercial strains of "variegated alfalfa" are: "Grimm" — "Baltic" — "Canadian variegated" — "Sand Lucerne". With the exception of the last, they have been found more resistant to cold than the remaining commercial strains or varieties; they are consequently recommended for zones where winter frosts are frequent.

Peruvian alfalfa is unable to withstand severe winters and can only be successfully grown where the winter temperature is relatively mild, *i. e.* in the Southern and South Westerly States. Under favourable conditions the yield surpasses that of all other commercial varieties. Arab alfalfa is not a satisfactory variety as it tends to be short-lived.

The farmer should pay particular attention to the quality of the seed: thus, well-filled seeds, olive green in colour, are almost sure to germinate well whilst cracked or brown coloured seeds usually germinate with difficulty. It is also necessary to be on one's guard against inclusion of too high a proportion of weed seeds or other impurities.

In view of the fact that lucerne does not seed satisfactorily in a moist environment, it is practically useless to attempt cultivation for seed production in the Eastern States.

Selection of lucerne offers great possibilities, but involves so much time and expense that it cannot be undertaken by the farmer himself; this work should be left to the care of special institutions.

33 — **Work on Great Millet (*Sorghum vulgare*) and Bersim (*Trifolium alexandrinum*) in Egypt** (1). — BOLLAND B. G. C., in *Egyptian Ministry of Agriculture, Technical and Scientific Bulletin*, No. 8, pp. 8. Carro, 1916.

*Bersim* is the term applied to four varieties of clover belonging to *Trifolium alexandrinum*, a plant apparently of Egyptian origin, and giving rich crops, which are taken in the winter and spring. Of the four varieties, *Ba'li*, *Fahl*, *Khadrawi*, and *Misqawi*, *Fahl* is easily distinguishable by its taller, quicker and more luxuriant growth.

*Misqawi* and *Khadrawi* have many common characteristics, and are better in growth than *Ba'li*, but are not up to the standard of the *Fahl* variety. The following table gives the measurements of the varieties.

If only one cut is desired, *Fahl* is the best variety to grow, as it gives no aftermath. The other varieties give fresh growth after being cut. A mixture of *Fahl* and *Misqawi* obviates the difficulty and gives a better yield than if *Misqawi* were sown alone.

(1) See B 1910, p. 63; B 1911, No. 812 and 2561.

(Ed.).



Variety	Height in cm.	Number of leaves per plant	Length of leaves in cm.	Breadth of leaves in cm.
<i>Fahl</i> . . . . .	76.6	42	5.0	1.8
<i>Misqāwi</i> . . . . .	44.5	23	4.8	1.9
<i>Khadrāwi</i> . . . . .	56.8	26	4.3	1.7
<i>Ba'li.</i> . . . . .	48.3	23	4.1	1.6

34 - *Sulla* (*Hedysarum coronarium*) in the Agriculture of Southern Italy. — JOVINO S., in *Giornale di Agricoltura della Domenica*, Year XXVI, No. 39, pp. 316-317, Piacenza, September 23, 1916.

While the other leguminous meadow plants, like vetches, crimson clover, lucerne, sainfoin, spread everywhere in the agriculture of southern Italy, *sulla*, the best of all forage plants for the clayey-calcareous soils of the south only appears occasionally, excepting those places where it grows naturally, in rare artificial meadows of this plant.

Natural meadows of *sulla* are common in the south, and much *sulla* hay is produced on fallow land, most often with little cultivation after a cereal crop. But, to retain this wild *sulla*, deep cultivation is avoided, thus causing injury both to cereals and forage.

This disadvantage was proved by the low yield of natural meadows of *sulla* in 1914 because of the drought, in 1915 because of the excessive rain. In 1916, the best natural meadows of *sulla* at Matera produced hardly 20 quintals of hay per hectare. On the other hand an artificial field laid down in 1913 on the property of the Faculty of Agriculture of Matera produced 50 quintals of hay per hectare in 1914 at one cut in May. In 1915, on another meadow laid down in 1914, *sulla* yielded 100 quintals of hay per acre; on another laid down in 1915, a crop of 90 quintals of hay was recently produced. A previous deep cultivation allows the strong root-system of the plant to penetrate deeper in the soil and thus resist lack of water.

*Sulla* hay as produced in the south, both from natural and artificial meadows, is very coarse, which is one of the principal popular objections that prevent its spread. On natural meadows, this is due to the habit of cutting late, after flowering and sometimes even when fructification is well advanced. For artificial meadows, it is due to this habit and to the luxuriant growth of the plant, as well as to the thickening of the stems cut only once in spring. But it should be noticed that natural *sulla* hay from the south, cut just at the beginning of flowering, is in no way inferior to good clover hay. By pasturing on the *sulla* in winter, or by what amounts to the same thing, cutting in winter a good cut may be had in May. This has been subjected to experiments which gave the following results:

		Yield in green sulla per hectare	
		with winter cut	without winter cut
First cut:	Jan. 15, 1916. . . . .	300 quintals	— —
Second cut:	April 19, 1916. . . . .	280 "	440 quintals
Total . . . .		580 quintals	440 quintals

A sulla meadow cut twice produces not only more abundant spring pasturage and 30 % more than with a single cut, but it gives equally fine and succulent pasturage in January as well as in April. In addition the winter-cut sulla stooled considerably, so much so that the single cut sulla did not have more than 6 stems per plant, while the twice-cut sulla had up to as many as 24 stems.

It is not easy to obtain 580 quintals of forage per hectare in central and southern Italy without irrigation, neither with lucerne, sainfoin, nor with temporary grassland. Given that, in the southern and non-irrigated regions, intensive breeding will be more and more practised on the half-housing system, then the two-cut sulla will provide the requisite of a suitable winter pasture.

Sulla is unequaled on clayey-calcareous soils, and with suitable cultivation, does well in all other types of soil, according to SBROZZI, provided that the climate will allow it. The writer has visited excellent fields of sulla having been laid down on soil formed from the disintegration of tertiary conglomerate, which soils are very extensive in the south. The excessive winter humidity and the consequent lack of air in the soil render cultivation of the upper layers indispensable for draining the soil, without which the sulla may become weakly or even rot. The use of manure, since sulla has been grown in the south, was found to be very useful ; it may even be considered as being among the best long-lived plants grown in the south as regards its utilisation of manure.

Bacterial inoculation of soils that have never grown sulla does not appear to be always necessary, as a good dressing of manure may often suffice. The specific bacterium may be present, or may be derived from the bacterium of another species of *Hedysarum*, a common wild plant in the south, and close to sulla: *Hedysarum spinosum*. In a gravelly southern soil of lateritic loess on Monte Scagnoso, sulla succeeded without inoculation only after 5 attempts, four years being failures. In cases like this, inoculation should certainly be given with soil on which sulla had been grown. After inoculating with 30 quintals of the soil per hectare, Dr. MAUREA was easily able to introduce the growth of sulla in Capitanata on the soils of ordinary quaternary terraces. The action of the inoculation was evident, as was shown by the places where the soil for inoculation (which came from the Abruzzi) had been unloaded. In order to commence growing sulla with better results, Dr. MAUREA always adds a few kg. of sulla per hectare to the seed of other forage plants (clover, vetch, lucerne, sainfoin). The husked seeds of the sulla are soaked in warm water, and then are sown at the beginning of October in the south of Italy ; it is grown with oats, which are first

covered with a gang-plough or a weeder, then the sulla is covered more lightly.

Sulla thus sown on ground that has already grown the plant, normally gives a cut mixed with stubble soon after harvesting the oats. In the following year, 100 quintals of hay per hectare are often obtained. The year after, it yields, according to the weather, 60 quintals or more per hectare, after which the field is broken up. On the other hand, in hilly districts, spring sowing is more advisable, if it follows after winter cultivation, while if sown on winter cereals, it is liable to fail owing to lack of water at germination.

As has been remarked previously, sulla will have, according to the author, the merit of regenerating agriculture in the dry soils of the south of Italy.

**35 - Nettles as Forage Plants.** — GARCIA SANTOS, in *A Vinha portuguesa*, Year XXXI, No. 9, pp. 276-280. Lisbon, September 1916.

The writer advises the growth of nettles on ground that cannot be used for other crops, but which is not excessively dry, and in regions where forage is scarce. Nettles are very resistant to extreme temperatures, whether high or low, and have been long grown for forage in Sweden. Several writers have advised its growth in France, as its qualities have not been properly realised up to the present. It is sown in lines of 12 to 16 cm. apart in August or September; 10 kg of seed per hectare are used mixed with sand to obtain a uniform distribution; the seed is harrowed in. No cultivation is needed and manure should be given every three years. 3 cuts a year can be made before the stems begin to harden. The cut plants are left lying on the ground for some hours. When the plants wither, the stinging hairs lose their liquid contents and become harmless. Before giving this forage to animals it should be beaten or well shaken. An analysis of green nettles gave: 12.8 % of protein — 4.9 % of fatty matter — 30 % of carbohydrates. The composition is therefore similar to that of the best meadow hay. This forage is suitable: for dairy cows, in amounts not exceeding one-quarter of the weight of the ration; it seems to produce a more butyrous milk and butter of better quality and colour — for pigs, mixed with offals and potatoes — for poultry, finely powdered and mixed with offals, potatoes or flour: it promotes egg-production. When using nettle hay, it should be wetted with warm water or salted, and the infusion thus obtained given to the animals, who drink it readily.

**36 - The Introduction of the Cultivation of the Coffee-tree into Reunion.** — DE VILLELÈ AUGUSTE, in *Revue agricole de l'Île de la Réunion*, 11th. Series, Year 4, No. 6, pp. 215-233. Saint-Denis, Reunion, June 1916.

The first attempt to introduce the cultivation of the coffee-tree into Bourbon island, or Reunion, dates back to 1712, when the Lords of Saint-Malo obtained from the king of Yemen the permission to take coffee plants from Moka to plant in their island. This task was entrusted to LAGREDOLLIÈRE, but the plant obtained died during the journey. Another attempt, made in 1715, also failed. Finally some cargoes of coffee were sent to Re-

STIMULANT,  
AROMATIC,  
NARCOTIC  
AND MEDICINAL  
CROPS



union (two in 1719), and were found to contain whole fruits; this resulted in the planters becoming aware that a plant growing in the woods of the island and producing similar fruits was probably a native coffee-tree. The fruits were gathered and prepared in the way reported to be usual in Yemen and it was found that the island had a wild native coffee-tree; soon after, the first cargo was sent to France. The plant was only studied botanically at a much later date, using a plant coming from the Isle of France and named *Coffea mauritiana*.

In 1717, M. BEAUVOLIER DE COURCHANT, governor of Reunion, obtained several coffee plants during a visit to Moka, but all died on the voyage save one which was given to the care of BOUCHER DESFORGES, then the king's lieutenant at St. Paul. This plant grew well, produced fruit and was quickly propagated. From 1727 to 1731 this colony produced 1 286 000 lbs. of coffee bought by the India Company at 4 *d.* to 5 *d.* per lb. During the years following the introduction of the coffee tree, the island was several times devastated by cyclones; the growth of coffee further suffered because the India Company refused to buy more than 1 million pounds of the coffee produced by the island, which was then (1743) producing 300 million pounds. At this time the establishment of new coffee plantations was forbidden under pain of a fine of 200 *piastres*, and a Commission was appointed to destroy all new plants and 4 times as many of the old ones.

The reputation of Reunion Coffee was now made; the town of Bas-sora, which up to that time used to buy supplies from Moka, asked for 300 bales of Bourbon Coffee from the India Company. In 1757 DE FLOTTE wrote after visiting the island: "here one sees fine plantations of coffee reputed to be the next best after that of Moka".

In 1767, GRESLE introduced the "black wood" from India (*Albizzia Lebbek*), for shading the coffee-tree. The plant soon spread through the plantations, but was unfortunately killed by disease in several localities, and its death caused that of the coffee tree as the dead roots poisoned the soil. Then came attacks of insect pests such as *Elachista coffeella* and *Lecanium coffeae* (the latter has wrongly been stated to be of recent introduction). In 1820, the advisory council of the island, thinking that the coffee-tree was degenerating, asked the French Government to send new seed. PROF. PAUL THOUIN, being consulted, advised grafting the Moka coffee tree on the species cultivated in the colony.

Other coffee-trees of different origin from that introduced by BEAUVOLIER DE COURCHANT, but not defined, had been introduced; such as myrtle or Eden Coffee, the extremity of whose leaf, not such a deep green as that of Arab coffee, was then of reddish colour, and the Lervy coffee which, according to BILLIARD and DR. VINSON, has been imported from Africa, but, from certain information obtained by the writer, has resulted by mutation from the Arab coffee-tree, which is called "local coffee-tree" (1).

(1) In Réunion there are 2 varieties of *Coffea arabica*: one with round or oval seed, called "local coffee" in the colony, and on the European markets, "round Bourbon", the other

In 1823, the Governor of Reunion sent NICOLAS BRÉON, director of the "Jardin du Roi" of the Colony, on a mission to Arabia to bring new coffee seed. BRÉON brought, as well as seeds of *Cordia amplifolia*, the tree used in Moka and Bet-el-Fangui to shade the coffee-tree. (The possibility of the introduction of *Lecanium viride*, *L. nigrum* and *L. coffea* with these importations must be excluded, judging from the precautions taken). Nevertheless the introduction of new seed in no way modified the situation of coffee growing, gravely menaced by the competition of the sugar-cane, and the impoverishment of the soil, which received no manure other than that of the leaves fallen from the shade trees.

In 1878 M. JULES POTIER, director of the Bourbon Colonial Garden, while visiting the Maurice Island Exhibition, brought coffee leaves infected with a fungus from Pamplemousse to the Colonial Garden in order to examine the parasite which he identified as *Hemileia vastatrix*. The parasite infected the Colonial Garden, and soon spread through the island, diminishing the production of coffee from 534 720 kg. in 1878 (from 3 895 hectares) to barely 190 000 kg. in 1883 (from 5 682 hectares).

In 1879, new seed was bought from London and Ceylon; seeding in the Colonial Garden produced 900 young plants, sold in 1880 to various growers; at the latter time, 60 000 seeds of *Coffea liberica* were introduced from Ceylon. Through M. EMILE CHRIST seeds of the following plants were introduced: *Coffea excelsa*, *C. robusta*, *C. canephora*, *C. congensis*, *C. koniloniensis*, *C. maragogipe*.

37 - **The Influence of Different Treatments of Beet "Seed" on the Beets resulting after Sowing.** — FALLADA O. and GREISENEGGER. I. K., in *Oesterreichisch-Ungarische Zeitschrift für Zuckerindustrie und Landwirtschaft*, 45th Year, Part. 4, pp. 336-348, Vienna, 1916.

SUGAR CROPS

The question of a suitable treatment for the "seed" of beets in order to assist growth and consequently increase the yield of roots or sugar has been the subject of many researches. Thus, GUNTHER proposed the decortication of the false fruits before sowing, TENSEN advised soaking them in water till swollen, and HILTNER has advocated maceration in concentrated sulphuric acid.

Because of the divergent results of these treatments, new experiments were repeated with the exception of the decortication of the false fruit, a proceeding considered by the majority of experts as positively harmful.

The false fruits (commercial "seed") of the beet variety "Dobrowitz Original" were divided into 4 lots treated in the following manner:

Lot. I. — Soaking in cold distilled water till swollen for 12 hours just before sowing.

Lot II. — Maceration on the HILTNER method: the false fruits were gradually mixed with  $\frac{1}{4}$  of their weight of concentrated sulphuric acid,

with elongated berries, called "Leroy coffee" on the island and, in the trade, "pointed Bourbon".

"Round Bourbon", because of its exquisite aroma, has always been the variety most in demand. — Cf. E. DE WILDEMANN, *Les plantes tropicales de grande culture*, Vol. I, p. 99, Bruxelles, Castaigne, 1908. (Ed.).

stirring constantly for 2 hours, then sprinkled with quicklime and afterwards washed three times.

Lot III. — *Soaking in a 0.25 % solution of "Uspulun" for 4 hours before sowing.*

Lot IV. — *Control.*

Sowing was carried out in the spring of 1915 on 12 different plots that had received, per acre: 14 tons. of farmyard manure before winter; in early spring 56.2 lbs. of water-soluble phosphoric acid (superphosphate); 79 lbs. potash (potash salts); and 47.7 lbs of nitrogen (nitrate of soda).

The total area of the 12 plots amounted to about 50 sq. yds. so that each of the lots comprised 3 plots each of a little over 4 sq. yds.

Sowing took place on April 24, the leaves appeared between May 2 to 8 and the crop was gathered 208 days after sowing — November 17. At first, no great differences of growth were observable between the various plots. Nevertheless it was seen that, in spite of sowing the same quantity of "seeds" the plots sown with macerated seeds showed a smaller number of individual plants, but closer examination showed that these same plants were of more vigorous growth from the start.

The seeds macerated in sulphuric acid appeared the first with a gain of 6 days over the control plot, and of 2 or 3 days over the seeds swelled in water or in "Uspulun" solution (1). The appended table gives the results of the experiments, the results being very satisfactory, including those of the control plot. The treatment of the seed was shown to be worth while; maceration in sulphuric acid gave the best results, though the process is not quite free from objection.

### *Experimental Results.*

Treatment of the Fruits	Number of Beets	Results of the crop				Proportion of leaves for 100 of root	Results of tests				Grams of sugar in 1 beet
		Total crop		For 1 beet			Sugar Con- tent	Composition of the juice			
		in lbs.		in grms.				Degrees Balling	Sugar content	Quotient of purity	
		Roots	Leaves	Roots	Leaves						
											grm
Control. . . . .	42	50.34	27.43	549 g	301 g	54.7%	19.65 %	23.37	21.36 %	91.4	107.98
Swelling in water	43	53.61	27.43	567	290	51.2	19.35	23.13	20.80	90.3	109.7
Maceration in sulphuric acid.	39	56.54	28.49	639	329	51.6	19.15	23.12	20.80	89.9	122.4
Soaking in "Us- pulun". . . .	44	56.54	28.16	589	293	49.9	19.30	22.78	20.82	91.4	113.3

(1) See No. 100 of this *Bulletin*.

(Ed.).



38 - **The Influence of the Lime: Magnesia Ratio in the Soil on the Yield in Seed of Sugar-beets.** — FALLADA O. and GREISENEGGER I. K., in *Oesterreichisch- Ungarische Zeitschrift für Zuckerindustrie und Landwirtschaft*, 45th. Year, Part 3, p. 117-122, Vienna 1916.

Experiments to determine the influence of manurial treatment with magnesia on the yield in seed of sugar-beets. The experiments were carried out in pots, divided into 3 groups and containing soil very poor in lime and magnesia and made up of 94 % of tertiary quartz sand and 6 % of washed and then dried super-aquatic turf. In Group I, the lime and magnesia were added in the ratio of 1:3; in Group II in the ratio 1:1; in Group III in the ratio 3:1.

In the pots flowering beets of equal size were planted. The necessary water was given by watering with the KNOP nutritive solution. The calcium and magnesium were given in the form of finely powdered hydrated sulphate. The plants developed normally in spite of individual differences in the development of the aerial parts. The crop was gathered in the following manner: stems and leaves were cut off close to the beet and preserved; after 4 weeks the inflorescences were separated from the stalks and the seeds were then detached from their envelopes and weighed. The weights of envelopes and stems were also ascertained. These weights, combined to form a table, show that the results differ according to the individual plants. In Group I the yields in inflorescences varied by more than 100 %. The weight of the stems varies somewhat less than that of the inflorescences. The weight of these latter increased on the average parallel with the increase of the proportion of lime. In Group I, the weight of the stems is 3.5 times as great as that of the inflorescences; in Group II, the preponderance of the former decreased notably; in Group III, the inflorescences represent almost half the weight of stems and leaves together. With the ratio lime: magnesia equal to 1:3, the inflorescences form 22 % of the total yield; with the ratio 1:1 they form 26 %; and with the ratio 3:1, it increases to 35 %. Thus the increase in the amount of lime given resulted in a noteworthy increase of the weight of the inflorescences, which is of great importance for the selector and breeder of seed.

The water consumption of the various groups was also determined and compared with the production. It was found that the absolute quantity of water required was practically the same for all the groups. The increase of the lime content of the soil so as to equal that of magnesia resulted in a 7 % decrease in the water consumed in relation to the aerial parts. Nevertheless, the most important result was that, given equality of the absolute water consumption, the pots with a lime magnesia ratio of 3:1 produced almost twice the amount of inflorescences than those pots having the ratio 1:3. If, on purely sandy soil, the economy of water is shown so distinctly, a great economy still may be expected in heavy soils, where the flocculating action of lime can be seen more clearly and cause an increase in the production of the inflorescences — a sign of better utilisation of the reserve moisture.

If the lime factor does not seem to have, in itself, much importance

for the development of seed-producing beets, yet the lime-magnesia ratio of the soil is of considerable importance for the formation of the inflorescences.

A predominance in ratio of magnesia in the soil is unfavourable for the production of inflorescences. With a lime-magnesia ratio of 3 : 1, the yield in inflorescences is almost double of that obtained with the ratio 1 : 3.

The increase of the lime content of the soil decreases the relative consumption of water. The factor "lime" and the ratio lime : magnesia deserve the attention of those growing beet seeds.

- 39 - **The Peanut (*Arachis hypogaea*) and its Products.** — THOMPSON H. C. and BAILEY H. S., in *United States Department of Agriculture, Farmer's Bulletin* 751, 16 pp. Washington, D. C., August 4, 1916.

Peanut oil is one of the most important of the world's food oils. In 1912, over 120 000 metric tons of peanuts in the shell, and about 240 000 metric tons of shelled nuts were crushed at Marseilles; about 15 500 000 gallons of edible oil and about 23 000 000 of inedible were thus obtained. In the same year, Germany imported 68 765 tons of peanuts, practically all of which were used for making oil. The imports of peanut oil entered for consumption in the United States for the year ended June 30, 1914 amounted to 1 332 108 gallons valued at \$ 915 939. Almost exactly half of this oil was imported through the port of Chicago, which would indicate that a large portion of it was used in the manufacture of oleomargarine.

There are at least 10 geographically different varieties of peanuts quoted on the Marseilles market. Those from the French colonies of West Africa (Gamba, Rufisque, Kasmanze, Rio Nuez and Bissagos) are usually imported in the shells, while the shelled nuts come from China, Mozambique, Bombay and the Coromandel coast of India. Peanuts in the shell from Rufisque, Soloum, Sina and Gambia contain from 35 to 36 per cent. of oil, and yield on a large scale from 28 to 30 per cent. of shells and 31.5 to 32.5 per cent. of oil, which correspond to 44 or 45 per cent. of shelled nuts.

The cake usually retains from 8 to 9 per cent. of oil. Kasamanze peanuts yield from 30.5 to 31.5 per cent. of oil. The decorticated nuts from Bombay and Coromandel yield 36 to 38 per cent, while those from Mozambique yield from 40 to 42 per cent. The best grade oils are made from stock shipped in their shells, as with these there is less opportunity for spoilage during the voyage. Chinese peanuts are however, an exception to this rule, for they are shelled almost entirely by hand, and carefully protected from water, or crushing. On the other hand, peanuts from the Coromandel coast are largely shelled by wetting them down with water, so that they open of their own accord: they can only be worked up for soap stock.

In the southern States of North America, especially in the districts infested with *Anthonomus grandis* the cultivation of the peanut has made rapid progress. On the other hand until 1915, very little peanut oil was manufactured in the United States. The problem now presents itself under two forms: how to use the excess production of peanuts, and decrease the large importation of peanut oil.

There are 5 distinct varieties of peanuts grown in the United States:

— “Spanish” — “Virginia Bunch” — “Virginia Runner” — “Valencia (or “Tennessee Red”) and “African” (or “North Carolina),

Any of these could be used for the extraction of oil, but the “Spanish” variety is the best, and is the only one that should be grown for this purpose. In a shelling test of farmers’ stock made by the United States Department of Agriculture, “Spanish” peanuts shelled out at 78.70 per cent, the “Virginia Bunch” 71.15 and the “African” 71.45 per cent (the weight of the unshelled nuts being taken as 100). In this test, the peanuts were shelled by hand; in a commercial shelling plant, at least, 10 per cent less nuts would have been obtained.

The writers give the analyses of 12 commercial samples of “Spanish” and of 19 of “Virginia” peanuts (these 2 varieties being most grown). The averages of the 2 series of analyses are given in Table I.

TABLE I. — *Analysis of peanuts of the “Spanish” and “Virginia” Varieties, as grown in the United States.*

	Moisture	Oil	Oil (dry basis)	Ash
	—	—		—
“Spanish” . . . . .	3.9 %	50.0 %	52.5 %	2.4 %
“Virginia” . . . . .	4.1 %	41.7 %	43.3 %	2.7 %

It will be noticed that there is a difference in the amount of oil of about 9 per cent in favour of the “Spanish” variety. On the other hand, there is very little difference between the oil content of the 5 varieties cultivated under the same conditions. This is shown by Table II.

TABLE II. — *Analyses of 5 Varieties of Peanuts Grown at Florence (South Carolina).*

Varieties	Constituents of shelled nuts					Constituents of shells				
	Moisture	Oil	Crude fibre	Protein	Ash	Moisture	Oil	Crude fibre	Protein	Ash
Virginia Runner. . . .	3.35 %	46.58 %	2.73 %	29.60 %	2.76 %	5.23 %	0.73 %	78.28 %	5.07 %	4.11 %
Virginia Bunch . . . .	3.28	45.73	2.84	29.52	3.11	5.23	3.53	70.00	7.25	3.95
Spanish. . . . .	3.30	49.10	2.30	31.20	2.67	5.03	3.20	66.70	8.16	6.81
Valencia . . . . .	3.75	49.60	2.13	33.64	2.67	5.80	1.38	70.72	7.23	3.34
African. . . . .	3.45	45.90	2.26	30.30	3.31	5.45	2.46	71.70	7.60	3.38

In order to make a very high grade edible oil, the peanuts should be thoroughly cleaned, shelled, blanched and degermed before being ground (between mills and rollers) and pressed. Experiments made in cottonseed-oil mills in the United States show that the presses now in use can be used for making peanut oil. The first pressing should be made cold, in order to get a high grade edible oil, the second should be made after regrinding and heating the cake from the first pressing. It is doubtful whether more than 2 pressings should be made in the United States. The oil from the second



pressing might be refined and used for cooking, or for the manufacture of oleomargarine, or it might be used without refining for soap making.

The principal by-product of pea oil manufacture is the meal. One ton of shelled "Spanish" peanuts will yield about 750 lb. of meal. This cake sells for \$ 30 to \$ 35 per ton and is an excellent cattle feed. Peanut meal has about the same value as a fertiliser as cotton seed meal, but its great value is for live-stock feeding.

The peanut hulls are also a by-product. They can be ground with the meal to give it bulk, but they add very little to the food value. They can also be used as fuel in the oil factory, or sold as litter.

The average cost of production of peanuts in the United States is \$ 20 to \$ 25 for a yield of 35 bushels per acre. At 70 cents a bushel for the peanuts, and \$ 12 a ton for the hay, the gross returns would be \$ 32.50. At 70 cents a bushel for Spanish peanuts, the oil must sell for 60 to 65 cents per gallon in order to make a profit, calculated on the basis of 80 gallons of oil per ton of peanuts.

#### HORTICULTURE

- 40 - **On the Acclimatisation in France of a Quickly-growing Plant (*Rumex hymenosepalum*) containing Tannin.** — PIEDALLU ANDRÉ, in *Comptes Rendus de l'Académie des Sciences*, 1916, Second Half-year, Vol. 163, N° 20, pp. 575-576. Paris, November 13, 1916.

One of the causes of widespread deforestation is the manufacture of tanning material from oaks and chestnuts, plants of slow growth. To supply the works, while preserving the forests from destruction, tannin-bearing plants of rapid growth must be sought. While several *Polygonaceae* contain tannin, *Rumex hymenosepalum* Torr. ("Canaigre") is amongst the richest, as its tubers contain up to 28 or 30 % per cent of tannin. It can be successfully grown in Corsica and in southern France up to the Loire. It was supposed that this plant could not be grown in northern France, but experiments at Sèvres (Seine-et-Oise) continued for 3 years, showed that it can be grown all over France, since the plant was not injured during the winter of 1913-1914 by temperatures of  $-12^{\circ}\text{C}$ . These experiments showed that:

- 1) *R. hymenosepalum* grows naturally in the climate of Paris.
- 2) The vegetation retarded in autumn grows well in spring.
- 3) The plant resists winter cold well.
- 4) In a well cultivated and manured soil, the plant gives a useful yield, even in unfavourable localities with insufficient light and abundant parasites.

It is proposed to conduct field experiments in order to study the yield of the plant under practical conditions and also its yield of tannin in the climate of Paris.

- 41 - **The Effect of Continued Capillary Watering.** — DANIEL LUCIEN, in *Comptes Rendus des Séances de l'Académie des Sciences*, 1916, Second Half-year, Vol. 163, N° 19, pp. 525-527. Paris, November 6, 1916.

The Author has studied, in his garden at Erquy (France), the effects of continued capillary watering compared with the intermittent watering employed in market-gardening. For this purpose vessels with a large sur-

face were used filled with water in which were dipped strands of wool or cotton which acted as syphons. The water thus supplied to each plant was easily calculated, as well as being easily reduced or increased by altering the number of threads. This method of watering had for advantages: economy of water — no burning of the leaves, even if carried on in open sunlight. — freedom from washing out of nutritive substances from the soil. — loosening of the surface maintained to the highest degree.

3 series of experiments were started : in the first, lettuce, chicory, and cabbage were left almost entirely without watering ; in the second they received an abundant intermittent watering interrupted every 2 days ; in the third they received capillary watering, which may be called continuous and in which the water was delivered at the foot of each plant by syphons of variable number.

The plants watered at too long intervals gave the worst results : the lettuce and chicory flowered. Those having intermittent watering, with larger amounts of water than those given by capillary watering, at first grew normally, but in the long run their leaves became red and hard or of an unequal green colour. Those plants having capillary watering always had turgescient leaves of a fine green colour and showing perfect health. None of the foot watered plants flowered, which also happened for a fair number of specimens in the second series, although in less number than in the first.

The same system was tried for germinating seeds and afterwards watering the seedlings. 300 lettuce seeds, 300 headed cabbage seeds, and 300 radish seeds were used. The seeds were sown under similar conditions, divided into three lots and watered as in the previous experiments. The results obtained were :

	Number germinated		
	1st lot: almost without watering	2nd lot: intermittent watering	3rd lot: continual watering
Batavia Lettuce . . . . .	30	61	97
Cabbage. . . . .	57	68	82
Radishes . . . . .	43	57	80

It was found that continual capillary watering also gave plants much in advance of those of the other lots.

Anatomical study of the leaves, stems and roots has shown the differences that usually exist between plants suffering from drought and those with a normal supply of water.

With guaiacum stain, differences in the colouring of the latex of chicory were shown : the rapidity of the reaction and the intensity of the colouring were in proportion to good utilisation of the water. As the diastatic ferments did not act in the same way, it was explained by assuming differences in rhythmical development and in the nature of the products.

These experiments are of interest to both theoretical and practical

horticulturists. The author thinks that it will be easy to provide cheap and simple appliances, using capillarity, in order to provide cultivated plants with the water that they require in any given soil.

42 - **Varieties of Chicory in the Province of Lecce, Italy.** — MANNARINI ALBINO, in *Bollettino della Società orticola Varesina*, Year 4, N. 41, pp. 7-10, 8 fig. Varese, November 1916.

In the kitchen-gardens of the region of Lecce, 3 varieties of the type *Cichorium Intybus* are known and called "cicoria Catalogna" "cicoria di Brindisi or brindisina" and "cicoria all'acqua". Their origin is unknown, but it seems that they have originated from selection and fixation carried out by the market gardeners of the region of Lecce. They are purely local and are much grown from Cape Leuca up to above Taranto, and much less in the province of Bari. In the rest of Italy they are hardly known, save in the gardens of Naples and Rome, where they have been grown on a small scale for some years, the seeds being now and then imported from the region of Lecce.

A firm in Upper Italy sells the seeds of all three varieties under the general name of *Cichorium Intybus asparagoides*, for the shape of the stem is somewhat similar to the young shoots of asparagus. These three horticultural specialities do not require bleaching or any special preparation, while yielding an abundance of fine, hygienic and saleable product, that is preferred by those suffering from intestinal troubles.

"Cicoria Catalogna" (Catalonian chicory) has been known for a long time in the province of Lecce, as it was always, as it is now, the most grown of the three varieties. Like the other two, it has a much reduced root which is compensated for by the development of the stem which is hollow inside, conical in shape and clearly fasciated. The stem, which is the valuable part, is 40 cm long and 3 to 6 cm diameter at the base; it is tender, fleshy, with buds giving rise to little secondary stems also very tender; it is gathered by cutting at about 2 cm away from the crown of leaves. The plants form smaller and smaller shoots which provide the following crops. Among the three varieties, the Catalonian is nearest to the wild chicory for the slight pubescence covering the leaves and stem, the slightly bitter taste, the carmine colour predominating in the various parts of the plant, and the appearance of the leaves. The latter are usually pinnatifid, but they vary greatly, up to losing almost completely the divisions of the pinnatifid shape and to taking on an intermediate shape between linear and slightly lanceolate having slight crenations at the edges. The market gardener explains this by the presence of lettuce (*Lactuca sativa*) and prickly lettuce (*Lactuca Scariola*) in flower and which pollinates the "Catalogna". In addition, the gardener does not use plants for reproduction that have lost the clearly pinnatifid shape.

"Catalogna" chicory is grown in spring; it is planted as a seedling, then it is transplanted so as to remain at 35 to 40 cm distance apart in a square.

Gathering may be commenced at the end of March or at the beginning of April; there are distinct sub-varieties with varying degrees of earliness.



Special care is necessary to prevent the loss of the seed which is very light and small, and also to avoid pollination by related plants. There are 1300 seeds on the average in one gramme, while 300 to 400 plants are necessary to produce 1 kg. of seed.

The "cicoria brindisina" is further than the "catalogna" variety from the type plant, as is shown by the almost total absence of tap-root, the much reduced leaf, the almost total loss of the pubescence of the stem and leaves, the great attenuation of the rather bitter flavour, etc. It is a very good vegetable that can be grown throughout winter. It is planted in every month of autumn and winter, then it is replanted in squares of about 30 cm apart. It is gathered during winter and spring; seeding is more difficult than with the other two varieties as it is very susceptible to frosts at flowering time.

The "cicoria all'acqua" (water chicory) has practically the same botanical characters as the "catalogna" variety from which it only differs by its smaller stem, which only grows to 20 cm high and 2 cm diameter at the base. It is gathered in summer, being practically the only market-garden product to be found on the market during summer in that hot and arid region. As the plant requires a plentiful water supply, its growth is limited to swampy land in the regions of Otranto and Ostuni, or in those places where well water is brought to the surface. This plant deserves to be grown more extensively.

43 - **Studies of Apples in Oregon, United States.** — I. WHITEHOUSE, W. E., A Study of Variation in Apples During the Growing Season, in *Oregon Agricultural College, Experiment Station Bulletin* No. 134, 13 pp., Cornwallis, Oregon, June 1916. — II. KRAUS E. J., Variation of Internal Structure of Apple Varieties, *Ibid*, *Station Bulletin* No. 135, 42 pp., 31 plates, June 1916. — III. KRAUS E. J. and RALSTON G. S., The Pollination of the Pomeaceous Fruits, III; Gross Vascular Anatomy of the Apple, *Ibid*, *Station Bulletin* No. 138, 12 pp., + 8 plates, May 1916.

FRUIT  
GROWING

I. *Variations in Apples During the Growing Season.* — The object of these investigations was to determine whether there are more or less definite periods when apples under Oregon conditions make their main increase in bulk, and other periods when their characteristics colour markings are developed, or whether increase in size and colour are both quite uniform throughout the growing period.

The method employed to determine the size and form of the fruit was to record the largest transverse and longitudinal diameters of each individual fruit every two weeks throughout the growing season, beginning June 25th. These measurements were made with Vernier's callipers reading to  $\frac{1}{10}$  of a millimeter. The shape of each apple was ascertained by means of the "form index" which is obtained by dividing its transverse by its longitudinal diameter. At intervals, average fruits were taken from each of the trees under observation, weighed and the curves plotted; the increase in weight was then compared with the increase in size. In order to determine the amount of colour, the percentage of the surface of the fruit covered by its overlying colour was estimated every 2 weeks.

Records were kept of: the temperature — rainfall — and the approx

imate amount and intensity of the sunshine throughout the growing period, that it might be possible to correlate with the weather conditions any marked variation in rate of growth, or colour development.

The results thus obtained suggest several points of interest to the fruit grower. These are as follows :

If steady, gradual increase in size is normal for the apple, cultural conditions should be such that this steady growth will not be checked. In particular it would seem that tillage should be such as to provide a constant supply of moisture. Where irrigation is practised, it would seem unsafe to allow apples to become checked, depending upon later applications of water to force along the fruit and make up for deficiencies earlier in the season. Such practice might result in a specially rapid growth period, but the evidence indicates that this would be abnormal, rather than normal, if it occurred.

Often in thinning apples it is found convenient to remove the largest individual, or individuals, from the spur because of length of stem or some peculiarity of position. This investigation would lead to the belief that such is not good practice. The rank of an individual among its fellows at the time of thinning is a fairly accurate index to its probable rank at maturity. If experience shows that apples of a particular shape pack more easily in the type of package used, or take better in the market, than those of a different shape, a little bias in that direction can be gained by removing the undesirable shapes at the time of thinning.

A large part of the colouring matter of apples is deposited shortly before picking time. From the viewpoint of securing higher colour, it would seem that picking could often be delayed several days to advantage.

II. — *Variation of Internal Structure of Apple varieties.* — The data presented consist of 31 plates showing photographs made from transverse sections of apples (plates 1 to 20) and from transverse and longitudinal sections of pears (plate 31). The method adopted to prepare this material for being photographed, that is to say to render it perfectly transparent and show the detailed vascular structure, consisted in placing sections (of about  $\frac{1}{8}$  to  $\frac{1}{16}$  inches in thickness, and cut from the middle of the fruit) into 70 per cent alcohol. In this they remained for at least 24 hours, when they were passed through successive baths of absolute alcohol until they were completely dehydrated. The sections were then pressed lightly in filter paper, but not allowed to become dry; they were cleared first in cedar oil, and subsequently in a mixture of xylol and cedar oil.

III. *The Pollination of Pomaceous Fruits.* — The Division of Horticulture of the Experiment Station of the Oregon Agricultural College, at Corvallis, has commenced a series of studies of the pollination of pomaceous fruits. The first contribution to the question (E. J. Kraus, "Gross Morphology of the Apple," in *Oregon Agricultural College Division of Horticulture, Bulletin* No 1), was published in April 1913; a second ("Fruit Bud Development of the Apple") in *Station Bulletin* No 129, was published in May 1915; a third (E. J. Kraus and G. S. Ralston, "Gross Vascular Anatomy of the Apple", in *Station Bulletin* No. 138) in May 1916.



During the progress of the pollination studies, it became evident that various subsidiary factors, which may be more or less intimately connected with the pollination and development of the fruit had not been sufficiently investigated. One of the most important of these factors is the relationship that the vascular system of the fruit bears to its development. The writers devoted themselves to this study and, in the paper here summarised, they describe the vascular system of the normal fruit from its origin in the cluster-base, through the pedicel and fleshy portion of the fruit, noting the position, divisions, connections and terminations of the vascular system in the fruit. The "Yellow Newton" was the apple selected for investigation.

44 - **Varieties of Cider Apple Suitable for the Manufacture of Jelly, in France.** —

TRUELLE A., in *La Vie agricole et rurale*, 6th. Year, No. 46, pp. 357-361, 2 figs., 1 pl. Paris, November 11, 1916.

From previous researches, and in particular those of MR. BARKER (Long Ashton, England), on various varieties of apples with sweet, acid, or bitter taste, it is concluded that the two last categories have an important defect from the organoleptic point of view for the manufacture of jellies; the necessary concentration of their juice leaves a disagreeable taste in the finished jelly, due to excess acidity in the one category, and to excess of bitterness in the other. While these defects can be remedied to a certain extent by mixing with the juice of sweet or slightly bitter apples in suitable proportions, it is evident that it would be better to use these two kinds of apple at once, as it would avoid the long and awkward operation of mixing, always difficult in practice. The Author, following BARKER'S classification, arranges the varieties in the 3 following classes:

1<sup>st</sup>. *Class : acid varieties* : juice usually containing more than 0.45 gm. of malic acid per 100 cc.

2<sup>nd</sup>. *Class : sweet varieties* : juice usually containing less than 0.45 gm. of malic acid and less than 0.20 gm. of tannin per 100 cc.

3<sup>rd</sup>. *Class : bitter-sweet varieties* : juice usually containing less than 0.45 gm. of malic acid and more than 0.20 gm. of tannin per 100 cc.

The appended table gives the classification of 50 of the most widely grown varieties of cider-apple in south Normandy; they belong to the last two classes, acid varieties being very rare in that region. The common varieties of other cider-producing regions, such as Brittany, the districts of Othe and Thiérache, will also be studied.

From the table it will be seen that the varieties are classified thus:

*Sweet varieties* : Aufriche, Binet blanche, Binet rouge, Bisquet, Bonne Chamarière, Bouteille douce, Côtelée de Caumont, Doux-Evêque, Doux-Normandie, Haut-Grisé, Herbage sec, Joly rouge, Longuet, Manerbe, Marin-Onfroy, Orange, Rouge-Bruyère, Rouge-Durct, Rouge-Mulot, Rousses (Latour and de l'Orne), Saint-Martin.

*Bitter-sweet varieties* : Amer-Doux, Amer (Petit), Ameret blanc, Ameret rouge, Argile grise, Barbarie sale, Bédan, Bergerie, Cimètière, Citron, Crolon, Domaines, Doux-Lozon, Douze à gober, Fréquin rouge, Gallot, Gros



Average content of malic acid, tannin and pectins, in grms per 100 cc. of pure apple juice.

Varieties	Malic Acid	Tannin	Pectic substances	Varieties	Malic Acid	Tannin	Pectic substances
Bitter-Sweet. . . . .	0.262 grm.	0.235 grm.	0.39 grm.	Red Fréquin . . . . .	0.166 grm.	0.288 grm.	0.40 grm.
Bitter (Small). . . . .	0.262	0.337	2.65	Gagnevin. . . . .	0.146	0.182	1.25
Ameret White. . . . .	0.187	0.399	1.00	Gallot . . . . .	0.177	0.296	0.36
Ameret Red . . . . .	0.157	0.310	0.66	Red Gros Moteis. . . . .	0.206	0.317	1.10
Argile grise . . . . .	0.172	0.260	1.53	Haut-Bois . . . . .	0.157	0.180	1.50
Aufliche . . . . .	0.164	0.183	1.28	Haut-Grisé. . . . .	0.232	0.171	1.60
Barbarie Dull grey. . . . .	0.170	0.260	1.53	Herbage sec . . . . .	0.181	0.200	0.73
Bédan . . . . .	0.136	0.173	0.76	White Joly . . . . .	0.136	0.224	0.74
Bergerie . . . . .	0.236	0.304	0.75	Red Joly . . . . .	0.158	0.195	0.48
Binet White . . . . .	0.153	0.231	0.57	Longu t . . . . .	0.170	0.170	0.87
Binet Red . . . . .	0.170	0.191	0.18	Mançibe . . . . .	0.136	0.200	1.01
Bisquet . . . . .	0.205	0.140	0.70	Marin-Onfroy. . . . .	0.145	0.120	1.20
Bonne-Chambrière . . . . .	0.188	0.152	0.33	Moulin à vent . . . . .	0.293	0.464	1.17
Bouteille Sweet . . . . .	0.176	0.133	1.10	Muscadet (Petit) . . . . .	0.136	0.230	0.65
Cimetière . . . . .	0.136	0.216	0.60	Noël Deschamps . . . . .	0.206	0.348	1.90
Citron . . . . .	0.191	0.260	0.63	Orange. . . . .	0.136	0.170	1.13
Côtée de Caumont . . . . .	0.157	0.159	1.75	Or Milcent. . . . .	0.270	0.310	0.80
Crollon . . . . .	0.207	0.347	0.10	Orane . . . . .	0.262	0.245	0.21
Domaines. . . . .	0.164	0.215	0.46	Péau-de-vache, nouvelle. . . . .	0.150	0.260	1.48
Sweet-Evêque . . . . .	0.166	0.133	1.50	Rouge-Bruyère . . . . .	0.187	0.125	1.10
Sweet-Lozon . . . . .	0.136	0.263	1.60	Rouge-Duret . . . . .	0.157	0.118	1.40
Sweet-Normandie . . . . .	0.246	0.120	0.50	Rouge-Mulot . . . . .	0.150	0.144	0.43
Douze à gober . . . . .	0.259	0.270	0.45	Rousses (Latour et de l'Orne). . . . .	0.250	0.134	1.82
Feuillard . . . . .	0.205	0.120	0.16	Saint-Martin . . . . .	0.191	0.177	0.82
Filasse . . . . .	0.150	0.120	0.42	saint-Philbert . . . . .	0.169	0.260	0.75

*Matois rouge, Joly Blanche, Moulin-à-Vent, Muscadet (Petit), Noël Deschamps, Or Milcent, Ozanne, Peau-de-Vache nouvelle, Saint-Philbert.*

The excessive bitterness of a variety can be much diminished by allowing the fruit to attain complete maturity as long as they remain healthy : at the same time both sugar and pectic substances are gained, both valuable from the point of view of making jelly.

45 - **Varieties of American Peach-tree Introduced into Italy.** — ZAGO F., in *L'Italia agricola*, Year 53, No. 11, pp. 497-498, 1 coloured plate. Piacenza, Nov. 15, 1916.

During the last few years, the ROSSI brothers of Montescudaio (Pisa) have imported, mostly from the nurseries of Mr J. C. HALE of Winchester, Tennessee (U. S. A.), over thirty new American varieties of peach tree remarkable : for their resistance to adverse weather conditions ; for their vigorous habit ; their abundant and regular production of fruit ; by their fruit whose flesh is usually free from the stone, as in those American varieties previously introduced the flesh usually adhered to the stone.

The writer was one of the first to test the varieties introduced into Montescudaio, and has put about 20 into cultivation, on which observations have been made for about 5 years. It can now be stated that the varieties : " Victor, " " Waddel, " " Admiral Dewey, " " Carman, " " Belle of Georgia, " " Thurber, " " Elberta, " " Goldmine, " " Old Mixon Free, " " Matthew's Beauty, " " Chairs' Choice, " " Gordon, " " Henriette, " have the necessary qualities (vigorous plants of sufficient cropping power), and that several, like : " Elberta, " Matthew's Beauty, " " Admiral Dewey, " etc., are of very good habit, or crop constantly and sufficiently highly, like " Carman, " and " Goldmine. " A coloured plate is given of the variety " Chair's Choice " or " Crawford Late Improved. " It is a vigorous plant, standing adverse weather conditions well, not exacting, with a regular branch-system, with abundant and even ample foliage ; it regularly produces abundance of fruit. The peaches are large, with a yellow skin, with spots of bright red and velvet shades ; the flesh is yellow, juicy, tender, sweet, of delicate taste, and not adhering to the stone. It originated in Maryland. There is another and earlier (August) Crawford variety, but the one mentioned is the better, as much because of its cropping powers as for the large size and good quality of the fruit.

46 - **Citrus Conditions in Florida, Cuba, and California.** — FAWCETT H. S. in *California State Commission of Agriculture Monthly Bulletin* N° 9, Vol. V, pp. 321-337. Sacramento, September 1916.

The writer compares some of the differences in horticultural conditions and practices in California, Florida and Cuba in special reference to citrus culture.

Florida's citrus regions lie between about 25 to 30 degrees north latitude with 40 to 60 inches of rainfall during late spring, summer and early fall. California's citrus regions lie between 32 ½ and 39 ½ degrees with 10 to 20 inches of rainfall during late fall, winter and early spring.

Florida, therefore, has a moist, humid atmosphere during most of the growing season, making it possible to grow citrus fruit without irrigation,

while California, during this same season, has a dry atmosphere without rains, making it necessary to practice irrigation.

In Florida, cultivation is usually discontinued throughout the rainy season of summer, and in California is usually kept up during the summer because of the necessity of frequent irrigations and the conservation of moisture in the soil.

In Florida, cover crops of Beggarweed, cow peas, velvet beans, etc. are grown in summer, while in California, unless irrigation water is plentiful, summer cover crops give way to winter cover crops of vetch, *Melilotus*, etc.

In Florida, the soils are generally light and sandy and require large amounts of plant food for the best growth of citrus fruits, while in California, although the citrus soils are much more variable they average much heavier with a greater amount of clay, therefore, much richer in plant food.

The large number of standard varieties of both oranges and grape fruit in Florida give way to only a few standard varieties of oranges and one standard variety (Marsh Seedless) of grapefruit in California.

Lemons not now grown commercially in Florida are a very important crop in California, while grapefruit, on the other hand, is a very important crop in Florida and is of only secondary importance in California.

What is said about Florida is true for the most part as regards Cuba, except that Cuba lies between about 18 and 22 degrees north latitude and that the application to the soil of a continuous cover of vegetable mulch is practised more extensively.

The average soil of Cuba is heavier and richer in plant food than in Florida. Lemons, not grown in Florida, are grown commercially to a small extent in Cuba and grapefruit occupies three fourths of the commercial plantings.

In 1912, the writer planted a 12 hectare vineyard on the hillside in the commune of Saint-Drézery (Hérault, France), intercalating several experiment fields, with the object of testing the resistance to drought of several stocks. The results described were obtained from the "Red" field, which has a very homogenous soil, formed by a flinty grit and mixed with round stones; this soil belongs to the Bartonian Eocene and was formed by the decomposition of conglomerate mixed with alpine diluvium. The field was steam-cultivated to 80 cm. deep without touching the sub-soil.

The soil is of good physical condition, but poor in nitrogen, phosphoric acid, magnesia and lime. The experiment field, placed in the middle of a large vineyard planted with the Riparia variety, was spread over a hillside facing south. The rows of the various stocks 106-8, 101-14, 3 309, 333, 41-B, Lot, 157-11, 420-A were planted down the slope; all the stocks were grafted with the Aramon variety. The vine-yard was planted with root-grafts in 1912-13. The first foliage was produced in 1913, the second in



1914, the third in 1915 (first producing year, one of mildew and dryness), its fourth in 1916 (second producing year, great drought). The relative merit of the stocks was determined by comparison with Riparia. Tables are given to show the results of the last three years of observations, which gave the following conclusions: In 1914, the best results were given by: 106-8, 101-14 and 3 309; the Lot variety does not merit any special consideration; 420-A did badly. In 1915, No 106-8 was the best for resistance to drought, while 101-14 comes second. In 1916, No 106-8 came first for vegetation, production of fruit, resistance to drought; 101-14 may be classed on the same footing, but was more woody; 3 309 follows. The author was obliged to conclude that 106-8 would give a sure and constant crop in years with mildew and drought. No. 101-14 seems to possess the same qualities, with more vegetation and a lesser demand for manures.

48 - "**Pellaverga**", a good Italian Table Grape. — L'ISSONNE E. C., in *L'Italia agricola*, Year 53, No 11, pp. 489-491, 2 fig. Piacenza, November 15, 1916.

Attention is drawn to this variety, which apparently is not grown save on the hills of Saluzzo, though it is well worth cultivating more extensively as a producer of one of the best table grapes, easy to pack for carriage and of good keeping qualities (till the following spring).

The grapes are very large, with big seeds, thin but strong skin, a dark pink colour, firm pulp, very tasty and sweet. The "pellaverga" variety is easily adaptable to northern Italy, as it resists intense cold well when in unfavourable situations, but it does best on hill sides facing the sun.

FORESTRY

49 - **Forest Management in Morocco.** — LONG, in *Revue des Eaux et Forêts*, 5th. Series Year XVI, Vol. LIV, No 6, pp. 178-181. Paris, 1916.

From the Author's report on agricultural organisation in Morocco, the following information is obtained as to the Waters and Forests Department in Morocco.

This Department, started in 1913, could only be organised in 1914, and although the staff was considerably reduced (2 superior officers and about twenty officers and French forest-guards). The result of the first working year (1914-1915) may be considered as encouraging, as the receipts have almost equalled the expenses. The magnificent forest of cork-oaks at Mamora, rapidly being destroyed by the natives, has been put under regular control. The cork from 120 000 feet has been utilised in 1914-1915, and up to the present the control of two other forests has been organised.

In addition, about 60 miles of fire lines nearly 100 feet wide have been opened out; in 1915, three groups of ranger's houses were established, and 4 others in 1916, at the price of 25 000 fr. (£ 988) per house, each capable of accomodating the guard's family as well as the native staff and also suitable as a store, etc.

The expenses for the first three years are as follows (in francs) :

Renovating woods spoilt by the natives; cutting stumps of mutilated tree feet that would otherwise have soon died . . . . .	800 000 fr.
Opening fire-lines in such places where fires have occurred during the last 2 years, or are likely to occur. . . . .	600 000 »
Construction of 20 to 25 ranger's houses . . . . .	1 000 000 »
Nurseries, establishment, and various. . . . .	100 000 »
Utilisation of the wood at 0.30 fr. per foot for 6 million feet . . . . .	2 000 000 »
Total Expenses . . . . .	4 500 000 fr.

The forest administration is of the opinion that, under such conditions, the full utilisation of the Mamora forest and other cork-oak forests in the Rabat region could be attained in 5 or 6 years, which would mean a gain to the state of several millions of francs a year.

The political condition of the Atlas has as yet not permitted the study of a suitable division for cutting of the fine cedar forest situated to the south of Fez and Meknes.

50 - **The Spruce and Balsam Fir Trees of the Rocky Mountain Region.** — SUDWORTH G. B., *United States Department of Agriculture Bulletin No. 327* (Contribution from the Forest Service, Professional Papers), pp. 1-43 + Plates I-XXV + Maps 1-10. Washington D. C. 1916.

A dendrological study of the following forest trees.

1) Spruces : *Picea Mariana* (Mill). B. S. and P., known as the "black spruce" — *Picea canadensis* (Mill) B. S. and P. known as the "white spruce," rare in the Rocky Mountains, its main range being Canada and the north-east of the United States — *Picea Engelmanni* Engelmann, called "Engelmann's spruce" — *Picea Parryana* (André) Gardeners' Chronicle, known as the "blue spruce," or "Colorado Blue Spruce."

2) Balsam Firs : *Abies balsamica* (Linn.) Miller, known as the "balsam fir" — *Abies lasiocarpa* (Hook) Neittall, known as the "Alpine fir" — *Abies arizonica* Merriam, known as the "cork fir" — *Abies grandis* Lindley, known as the "Grand fir," or "white fir" — *Abies concolor* (Gord) Parry, known as the "white fir," properly so-called — *Abies magnifica shastensis* Lemmon, known as the "Shasta red fir."

The distinguishing characters of the above trees are given, together with their geographical distribution, from Mexico to Canada, from the Pacific slope to the Great Plains of North America and in the forest reserves.

It must be remembered that spruces are exceedingly important trees, both from the ornamental standpoint ("blue spruce"), and from the economic point of view. They yield superior saw timber ("white spruce" and "Engelmann's spruce"), and are used for the production of paper pulp (black spruce" and "white spruce").

The larger species of balsam firs produce excellent saw timber ("white

fir"), and wood pulp for paper making, (*Abies balsamica*); while some of them are important also because they form protection forests on steep slopes at high elevations where few other conifers can live.

## LIVE STOCK AND BREEDING.

51 - **The Comparative Values of the Intra-Dermal-Palpebral Mallein Test and the Examination of the Blood for the Diagnosis of Glanders.** — FROHNER, in *Monatshefte für praktische Tierheilkunde*, Vol. 27, No. 9-10, pp. 416-424; No. 11-12, pp. 465-541. Stuttgart, 1916.

HYGIENE

I. In 1915, the author was asked by the Prussian Minister of Agriculture to conduct comparative experiments on about 100 horses to decide the value of the eyelid mallein test and the examination of the blood.

From the point of view of diagnosis the two tests give practically the same results. Some cases of glanders can be proved by a blood test, and others rather by the eyelid mallein test. Thus the two tests should be combined in practice, especially if many horses are to be examined. Besides, they should be combined in such a case as when one or the other alone gives doubtful results. In cases of acute glanders, both tests may not uncommonly prove useless; then clinical examination is the surest and most generally sufficient method.

The eyelid test is simpler and easier than examining the blood. The taking of blood samples from a large number of horses is difficult and lengthy, especially if repetition is necessary, so the author is informed by the official veterinary surgeons of the "Magerviehhof" (market for ill-conditioned animals) of Friedrichfelde and by those of the central abattoir of Berlin. In addition, the difficult and complicated laboratory examination must be added.

Experiments made at the central abattoir in Berlin agreed with other results and have shown that the eyelid mallein test has no influence on the examination of the blood, as was formerly thought.

According to the authors' observation, the taking of the temperature at the same time as the eyelid test, which is advised by PROF. SCHMÜRER of Vienna, can not be done with a great many horses. These observations further showed that horses with glanders do not always show a rise in temperature, even when the eyelid test give a positive result.

From the point of view of veterinary police, it seems advisable, when carrying out these tests, to divide the total number of horses into small groups as far as possible, while considering their previous conditions in the stable. Thus, if some of these small groups are found to be free from glanders, the return of the sound animals can be carried out more quickly.

From the technical point of view, the mallein tests have given rise to the following observations: 100 horses can be mallein-tested in an hour.

Before testing, any secretion of the eyes should be observed accurately, as regards the kind (serous, mucous, or purulent) and the quantity (1 - 1.5



- 2 - 2.5 - 3). A purulent secretion provides a contrary indication for the examination of the eyes. Small, whitish grey secretions of the size of a lentil and seen in the morning in the interior corner of the eye of many healthy horses, have no importance. In examining the eyes, suspicion should only be entertained in the case of a mucous secretion mixed with pus at least of the size of a pea.

II. — From 1912 to 1916, the Prussian Minister of Agriculture again asked the writer to examine 151 horses which were to be slaughtered by order of the veterinary police as they were suspected of having glanders, as was indicated by the blood test. In 143 horses the presence of glanders was shown by the autopsy. The eyelid mallein test gave a positive result in 141 (*i. e.* 98.6 %) of the 143 glanders horses; in two it gave a negative result. Therefore the eyelid test failed in 1 to 2 % of the total number of cases of glanders. The blood test gave negative results in 5 cases out of 143, thus failing in 3 % of the cases.

For diagnostic purposes, the eyelid test is seen to be of equal value with the blood test, even for extensive researches. The author is therefore of the opinion that the combined use of the two tests should be legally enforced in Prussia in order to exterminate glanders by the veterinary police.

Many observations are given on the technique of the eyelid examination, the different methods of malleinisation and varieties of mallein, the beginning of the reaction in the eyes, the value of a rise in temperature correlated with the examination of the eyes, the proportion of leucocytes in the blood, etc.

52 — On the Possibility of the Infection of Pigs with the Flukes *Opisthorchis felinus*, *Pseudamphistomum danubiense*, and *Metorchis albidus*. —

CUIREA JOAN, in *Zeitschrift für Fleisch- und Milchhygiene*, Year 26, No 21, pp. 323-326. Berlin, August 1, 1916.

To decide the possibility of infecting pigs with these flukes, experiments were undertaken in 1914 and 1915. The Author gave different fish containing larval stages of *Opisthorchis felinus*, *Pseudamphistomum danubiense* (especially in tench) and *Metorchus albidus* (especially in roach) to young pigs.

First of all he gave to a 3 month old pig, for 55 days, in all: 40 tench (*Tinca tinca*) — 8 common bream (*Abramis brama*) — 1 Rudd (*Scardinius leuciscus erythrophthalmus*) and 1 *Aspius aspius*. Dogs and cats were used as controls, being also given tench and roach. In the post-mortem examination of the pig, the author only found 7 adult *Opisthorchis felinus* (7 mm. long by 1.48 mm. broad) in the gall bladder and bile ducts. The control animals, which had been given fewer tench than the pig, contained several *Opisthorchis felinus* and a large number of *Pseudamphistomum danubiense*. The fact that no specimens of *P. danubiense* were found in the pig's liver seemed strange, since according to the writer's experiments the roach (*Cyprinus*) and especially the tench in the Danube are more frequently parasitised by *P. danubiense* than by *O. felinus*.

A second experiment was therefore commenced by giving to another pig for 71 days, in all: 93 tench — 13 roach (*Blicca bjorkna*) and 2 bream.

The autopsy showed that the bile ducts were thickened and full of a greenish-grey, glairy liquid. In the liver of the pig were found 45 adult and 2 immature specimens of *Opisthorchis felineus* and one adult but not mature *Metorchis albidus*. The parasites had developed normally. The liver of this second pig also contained no *P. danubiense*. On the contrary, the controls (dogs) of the second experiment contained, as well as specimens of *Opisthorchis felineus* and *Metorchis albidus*, some specimens of *Pseudamphistomum danubiense*.

CONCLUSIONS. — 1) *Opisthorchis felineus*, and probably *Metorchis albidus* as well, can live as parasites in the liver of the domestic pig.

2) It may be that the pig is not parasitised by *Pseudamphistomum danubiense*, but further experiments are necessary to decide this question.

3) The presence of abnormally developed specimens of *Opisthorchis felineus* and *Metorchis albidus* in the liver of the domestic pig may perhaps be explained by the fact that the latter is not the final host of the *Distomata* in question.

53 — **The Control of Contagious Epithelioma in Chickens by Vaccination; Experiments in Nevada, U. S. A.** (1). — MACK WINIFRED B. and RECORDS EDWARD, in *The University of Nevada, Agricultural Experiment Station, Bulletin No. 84*, 32 pp. 19 fig. Reno, Nevada, 1916.

During the winter of 1914-1915 and the following spring, there occurred in Reno (Nevada, United States) a serious outbreak of a disease (or group of diseases) known in the United States under various names. Those in more common use are "contagious epithelioma," "chicken pox," "diphtheria in chickens," "roup," "canker," "swelled head," "sore head" and petite vérole, to which correspond the French names "épithéliome contagieux," "diphthérie des oiseaux" and "cancer" (2).

The writers thus were able to study the disease upon a somewhat extensive scale. The account of this work was published in the *Nevada Agricultural experiment station Bulletin* N° 52 in June 1915; the Bulletin here analysed presents the results in popular language with some amplifications, and summarises them as follows:

The identity of contagious epithelioma and diphtheria, or roup, of chickens, is with respect to its cause, a subject of controversy which will require further extended research to settle. For that reason, it is uncertain whether the cases dealt with in the experiments recorded in the bulletin in question were caused by pure contagious epithelioma virus, or were due to mixed infection.

The vaccination of flocks of chickens, in which contagious epithelioma has appeared, with attenuated virus prepared from the morbid products of the disease (according to the method described by MANTEUFEL and later by HADLEY and BEACH in the *California Agricultural Experiment Station Circular* N° 145. Dec. 1915), promptly checked the spread of the disease and had a markedly curative effect upon obviously infected birds. Cases of the

(1) See also *B.* December 1915 No. 1313.

(Ed.)

(2) Cf. CAGNY et COBERT, *Dictionnaire vétérinaire*. Paris. Baillière, 1904.

(Ed.)



disease thus treated were less prolonged and milder than untreated ones, and the mortality was materially reduced. Two injections were sufficient in most instances, but severe, advanced cases benefited by a third and larger dose.

Flocks containing 4 524 birds, 2 763 of them showing no symptoms, but severally exposed, and 1 761, or 38.94 per cent. visibly infected, were success fully treated by vaccination. The spread of the disease after treatment was negligible. The mortality was 373 birds, or 8.24 per cent of the entire number in the flocks, and 21.18 per cent. of the visibly infected ones.

In the above flocks, no unfavourable results worth consideration followed the administration of the vaccine. In two other flocks of 110 and 706 birds respectively, serious septic and toxic processes were apparently caused by it. On the whole, nevertheless, the treatment was satisfactory and successful, although the use of the preparation employed is not without danger, so that a more refined product must be devised. The discovery of such a product was the object of the writers' researches. Viewed in its most favourable aspects, contagious epithelioma in fowls is a serious and destructive disease and must be so regarded by both poultry owners and veterinarians who attempt to deal with it.

The duration of the immunity conferred by vaccination is not definitely known. Too great dependence should not be placed upon it as a means of prevention, when exposure is to be encountered several months later, until further experience upon that point is acquired.

#### FEEDS AND FEEDING

54 - **Larkspur Poisoning of Live Stock.** — MARSH C. D., CLAWSON A. B., and MARSH B., in *U. S. Dep. of Agric. Bulletin* N° 365. pp. 1-90 Washington, D. C., September 8, 1916.

Larkspur poisoning, due to different species of *Delphinium*, is one of the greatest causes of loss in western cattle herds in all the mountain regions between Mexico and Canada and from the Rocky mountains on the east to the coast on the west.

The recent experiments conducted by the U. S. Department of agriculture, a report of which is published in this professional paper, indicate that the various species of larkspurs are poisonous to cattle and horses but not to sheep. Except under unusual circumstances, however, horses do not eat enough of the plant to produce any ill effects. From a practical standpoint, therefore, it may be said that larkspur affects cattle only. It was also found that a quantity of the weed equal to at least 3 per cent of the weight of the animal was necessary to produce poisoning.

In the opinion of the investigators the fact that sheep are apparently able to feed upon larkspurs with entire immunity, may be utilized in some cases to protect the cattle. Where larkspur is especially abundant it is desirable to use the range for sheep rather than for cattle, or to combine sheep grazing and cattle grazing in such a manner that the areas infested with larkspur shall be first eaten down by the sheep.

On comparatively limited areas it may be possible to dig up the tall larkspur, but this is frequently too costly a measure to be adopted, and furthermore it is rarely possible to eradicate the poisonous weed completely.



Generally speaking, there are two great groups of larkspurs, the tall and the low.

The low disappear from the range early in July and cases of poisoning from them are usually confined to the months of May and June.

The tall larkspurs live through the summer season, making their first appearance in early spring. This is the time in which they are the most poisonous. After blossoming their poisonous character appears to diminish. Ultimately, it disappears and the plant dries up although the seeds remain poisonous. In Colorado most of the cases of poisoning from the tall larkspur occur in May and June with sporadic cases in July. In other localities the larkspurs blossom later and poisoning may occur as late as August or even September.

On the range the first evidence that the animal has been poisoned is frequently afforded by its falling down. After a short interval it will probably regain its feet only to fall again until the effect of the poison wears off. In severe cases it is ultimately unable to regain its feet at all and dies. Beneficial results may be obtained by treating the poisoned animals with hypodermic injections of physostigmin salicylate, pilocarpin hydrochloride, and strychnine sulphate, followed by hypodermic injections of whisky when needed.

55 - **Palm Kernel Cake ; Investigations carried out at the University of Leeds.** — CROWTHER CHARLES, in *The Journal of the Board of Agriculture*, Vol. XXIII, No. 8, pp. 734-749. London, November 1916.

The results obtained during the past 2 years by various investigators at the University of Leeds. The whole of the practical work was carried out at Manor Farm, Garforth ("Experimental Farm of the University of Leeds and the Yorkshire Council for Agricultural Education").

*Palatability of palm kernel cake.* The experiments of MR. H. J. HARGRAVES have proved that this product is not so readily consumed by stock as many other concentrated foods. There is considerable variation in this respect with cattle, but a uniform difficulty with sheep. In no case did the difficulty however, prove more than temporary. Attention was directed to the possibility of rendering the cake more appetising by the admixture of small quantities of other substances ; molasses, fenugreek etc., but with very little result. The difficulties are naturally less when the cake only forms part of the ration. Numerous tests were made with the following results :

Composition of mixture		Time required for complete consumption Mins
Palm Kernel Cake Parts	Linseed Cake Parts	
4	0	23 - 25
3	1	18 - 20
2	1	14 - 18
1	1	14 - 17
1	2	10 - 12
1	3	10 - 14
0	4	8 - 9

*Keeping Properties.* — The experiments carried out by W. GODDEN consist of comparative tests as to keeping properties of palm kernel cake and of 6 other kinds of cake. The results obtained are given in Table I.

TABLE I.

*Keeping properties of palm kernel cake compared with those of 6 other cakes*

	Percentage of oil in cake (expressed as percentage of dry matter)		Free fatty acids in oil of cake (expressed as percentage of oleic acid)	
	Initial	After 6 months storage	Initial	After 6 months storage
Uncorticated cotton seed cake . . . . .	5.33 %	5.47 %	61.48 %	87.44 %
« Soycol » cake . . . . .	6.01	5.85	20.95	65.33
Groundnut cake . . . . .	11.27	10.25	14.65	56.02
Linseed cake . . . . .	13.43	14.02	11.23	29.82
Coconut cake . . . . .	15.59	12.55	5.84	73.45
<i>Palm kernel cake</i> . . . . .	<b>10.38</b>	<b>10.76</b>	<b>5.70</b>	<b>40.93</b>
Soya cake . . . . .	6.61	7.22	5.18	16.37

During storage, in the case of the palm kernel cake, there were no changes in the proportions of albuminoids and oil in the cake, nor was there any development of amides. In both the laboratory and the farm, storage tests were made, and it was found that, though under severe conditions, when the cake was stored in a badly-ventilated vessel kept continuously at about 37° C., the palm kernel cake certainly soon became very rancid, all the other cakes did so also without exception.

*Digestibility.* The experiments on the digestibility of palm kernel cake were carried out on sheep by H. F. WOODMAN at Garforth, and yielded the results given in Table II.

TABLE II.

*Coefficients of Digestibility of Palm Kernel Cake compared with Cottonseed Cake.*

Constituents	Percentage Digestibility		
	Palm kernel cake	Palm kernel meal	Uncorticated cotton-seed cake
Total dry matter . . . . .	74.2 %	75.5 %	57.7 %
Organic matter . . . . .	75.9	76.7	58.0
Crude protein . . . . .	91.0	90.0	74.7
True protein . . . . .	90.9	89.7	72.0
Oil . . . . .	97.5	96.4	(100.0?)
Nitrogen-free extractives . . . . .	83.1	86.0	62.0
Crude fibre . . . . .	37.1	44.8	34.9

Applying now the respective digestibilities as found by the experiment, the proportions of digestible nutrients in the feeding-stuffs works out as in Table III which allows of a comparison being made of the food value of the 3 products studied in Table II.

TABLE III. — *The Proportions of Digestible Nutrients in Palm Kernel Cake, Extracted Palm Kernel Meal-Cottonseed Cake.*

Constituents	Percentage of digestibility		
	Palm kernel cake	Extracted palm kernel meal	Uncorticated cottonseed cake
Crude protein . . . . .	16.18 %	16.90 %	16.62 %
True protein. . . . .	15.86	16.32	14.47
Oil . . . . .	8.46	1.99	4.55 (estimated)
Nitrogen-free extractives . . . .	36.98	40.69	20.70
Crude fibre . . . . .	5.24	7.36	14.47

Using the formula:

Food units = (Digest. protein + Digest. Oil)  $\times$  2.5 + Digest. Carbohydrates + Digest. Fibre we get from the above Table the following "food units."

Palm kernel cake . . . . . 103.0 food units

Extracted Palm kernel meal . . . . . 93.8 " "

Uncorticated cotton-seed cake . . . . . 76.2 " "

*The influence of Palm Kernel cakes upon the yield and composition of milk.* — Experiments made by A. G. RUSTON on 5 cows which received the following rations:

Period I. (5th - 26th of June), pasture alone, without cake, or other added food. Palm kernel cake was then introduced gradually during a transitional period of one week.

Period II. (3rd - 24th July), ration consisted of pasture and cake, then another transitional week and finally,

Period III. (1st-22nd. August), pasture alone.

The results of the experiments are summarised as follows: the average of all the animals being given.

Daily milk yield per head . . . . .	Period II . . . . .	23.34 lb
	Average of Periods I and III. . .	22.88 "
Percentage of fat . . . . .	Period II . . . . .	3.99 %
	Average for Periods I and III . .	3.90 %
Daily yield of fat . . . . .	Period II . . . . .	0.93 lb
	Average for Periods I and III . .	0.88 "
Solids-not-fat in milk . . . . .	Period II . . . . .	8.46 %
	Average for Periods I and III . .	8.56 "
Daily yield of solids-not-fat . . . . .	Period II . . . . .	1.97 lb
	Average for Periods I and III . .	1.95 "



*Influence of Palm Kernel cake upon the composition of Butter Fat.* — These experiments, which were carried out by H. WOODWARD, consisted in examining, in the butter obtained, the characters furnished by :

- (1) The Koettstorfer number, or the saponification index.
- (2) Reichert-Wollny number ; (the number of cc. of a decinormal soda solution required to neutralise the *soluble* acids volatile in steam that are contained in free, or combined, state in 5 g. of fat).
- (3) Polenske number ; (the number for the insoluble volatile acids corresponding to the Reichert-Wollny number for the soluble volatile acids).
- (4) Iodine number.
- (5) Refractive Index.

The writer obtained the data for the butter of 2 cows. The results given in Table IV refer to the product of one of these, and are given as an example,

TABLE IV — *Physical and Chemical Constants of the Butter produced by a Cow Fed on Palm Kernel Cakes.*

	KOETTSTORFER Number	REICHERT- WOLLNY Number	POLENSKE Number	Iodine Number	Index of Refraction at 40° C.
Period I . . . . .	228.4	31.0	2.55	41.7	1.4523
Period II . . . . .	230.1	30.0	2.47	37.6	1.4513
Period III . . . . .	222.5	25.6	1.24	42.7	1.4529
Averages of Periods I and III . .	225.4	28.3	1.90	42.2	1.4526
Increase (+) or decrease (—) due to palm kernel cake . . . . .	+ 4.7	+ 1.7	+ 0.57	— 4.6	— 0.0313

56 — The By-products of the Decortication of Rice in the Feeding of Milking Cows; Experiments at the Zootechnical Institute of the Royal Higher School of Agriculture of Milan, Italy. — GIULIANI R., in *Minerva Agraria*, Year VIII, No. 19-20, pp. 217-219. Milan, Oct. 15-30, Nov. 15-30, 1916.

In 1915, the Italian Government prohibited the export of the by-products obtained in decorticating rice ("pula di riso") so as to assure that a certain amount of concentrated food would remain in the country. Yet it appears that no advantage was taken of this fact, so much so, that as considerable amounts had accumulated, export was again permitted. In 1916 the export was again prohibited, and, considering the lack of forage, all hesitations of breeders must be overcome as to the use of a food that can be obtained on good terms. It may be said that the use of these by-products is practically limited to the rice-growing regions, but it is com-

prehensible, considering the total production of rice in Italy (1) that the use of these by-products might increase if their physiological and economic advantages for cattle-feeding were clearly shown. The Director of the Higher School of Agriculture of Milan has drawn the attention of the Italian Minister of Agriculture to this fact and suggested the tests described in the above publication.

The literature on the subject is discussed and the two qualities of "pula di riso" on the Italian market are mentioned: in the first quality, there is a combined total of nitrogenous and fatty matter of about 24 %, in the second quality of 18 % (2).

These tests were intended to show: a) the feeding value of these by-products, b) their suitability or otherwise for feeding cattle and how and in what amounts they should be given; c) their influence on the quality and quantity of the milk; d) if they can be economically used for feeding dairy cattle, and up to what limits.

For these tests, 8 cows of the brown alpine variety were used, the test lasting 84 days, divided into 3 periods and 2 transition phases. During the first period of 15 days, the animal received a basal ration of grass, hay and bran; during the second period, after a transition phase, they had a ration of grass, hay, and "pula di riso" for 30 days. After another transition phase, there was a third 15-day period also with hay, grass and bran. To 4 cows were given 24% "pula di riso," at the rate of 0.770 kg. per kg. of bran, and to the other four 18% "pula di riso" at the rate of 0.860 kg. per kg. of bran, the quantity of "pula" given each day to each cow varying from 0.860 kg. to 2.580 kg.

The health of the animals remained good, save with those receiving 2 to 2.5 kg. of "pula" which had a certain frequent cough, which ceased on reducing the quantity of "pula."

The live-weight during the second period remained nearly constant or even slightly increased.

In comparing the average milk production during the period of feeding with "pula" with that of the other two periods, it is seen that the quantity of milk had not varied in any way that could be attributed to the substitution of "pula" for bran.

As regards the quality of the milk, there was a slight alteration in the fat content during feeding with "pula," while the physical and organoleptic characters remained about the same.

(1) See: International Institute of Agriculture, Bureau of Agricultural Intelligence - *International Trade in Concentrated Feeding Stuffs*, No. 2, 1916. (Ed.)

(2) See: C. BÖHMER, *Die Kraftfuttermittel*, III, 5, pp. 244-265. Berlin, 1903. — O. BURCHARD, *Reis und Reisabfälle. Die Futtermittel des Handels*, herausg. durch den Verband landw. Versuchs-Stationen im Deutsche Reiche, XVI, pp. 262-280. Berlin, 1908. — W.A. HENRY, *Feeds and Feeding, A Handbook for the Student and Stockman*, XIth. Ed., *passim*. Madison Wis., 1911. (Ed.)

Regarding the *economic results*, the following foods were given :

Ist and IIInd periods: total 30 days			IIInd period: 30 days		
Grass . . . . .	144	quintals	Grass . . . . .	144	quintals
Hay . . . . .	7.20	"	Hay . . . . .	7.20	"
Bran . . . . .	5.25	"	24 % "pula di riso"	1.79	"
			18 % " " "	2.19	"

The prices of bran and "pula di riso" on the Milan market were:

Wheat Bran . . . . .	22.50	francs	per	quintal
24 % "Pula di riso" . . . . .	13.00	"	"	"
18 % " " " . . . . .	10.00	"	"	"

Calculating from these prices, it is found that the bran for the 8 cows cost 118.12 fr., while the "pula" only cost 45.25 fr., which gives a saving of 72.87 fr. a month.

The results of these tests may be stated thus :

1) The by-products from decorticating rice are not injurious to animals ; but in no case should more than 1.5 to 2 kg. per head per day be given, as a larger amount causes a cough in the animals.

2) These by-products, given according to the indicated amounts, do not appear to injure the quantity or quality of the milk.

3) Under present conditions in Italy, "pula di riso" is a feeding stuff that allows considerable economy in feeding milking cows.

57 - **The Effect of Carrots on the Colour and Quality of Butter.** — In *Mark Lane Express Agricultural Journal and Live Stock Record*, Vol. 116, No. 4 440, page 457. London, 30 October 1916.

The following experiment was carried out at Wye Agricultural College (England) to ascertain: 1) how long a period it takes before a change of colour becomes marked ; 2) what is the minimum quantity of carrots required to alter the tint ; 3) will a mixture of carrots and mangels answer the same purpose ; 4) what effects have carrots on the churning character of the cream, the quality of the butter, and the percentage of fat in the milk.

For the experiment four cows of the Lincoln Red breed were picked out, the animals having calved down a few months previously.

Two of the animals were fed on 81 lb. of carrots and their ordinary allowance of cake, meal, and hay. Two others were fed in a similar way, mangels being substituted for carrots. The records were taken in February and March, and the feeding reversed — *i. e.*, carrots being substituted or mangels after the first month of the trial. The carrots used were Sutton's Red Intermediate.

A brief summary of the results is as follows :

Length of time before the effect on the colour is apparent. Butter made from carrot-fed cows.

1st week. — Very slight difference compared with that made from mangel-fed cows.



2nd week. — Difference more marked, less time occupied in churning and better grain and flavour.

3rd week. — A very good high-coloured butter, considering the time of year.

On reversing the order of feeding, it was noticed that the colour was maintained in a diminishing degree over two or possibly three weeks, whereas the cows that had previously had mangels responded slightly to their change of food, and would, no doubt, have done much the same as the other cattle. The experiment did not last long enough to answer finally the question as to how few carrots will give the required tint, but it may be said that half mangels and half carrots gave a more saleable quality of butter than those getting a full ration of mangels.

The change of food had the effect of slightly lowering the butter fat in the milk of one cow, and practically made no difference in the others. In no case did it fall below 3 per cent.

58 - **The Registration of Pedigrees in the United States.** — WAYNE DINSMORE, (Secretary National Society of Record Associations) in *The Breeder's Gazette*, Vol. LXX, No. 19, pp. 881-882. Chicago, Nov. 9, 1916.

STOCK RAISING:  
ORGANISATION  
AND  
ENCOURAGE-  
MENT

The progress that has been made in live stock breeding in America, admittedly greater than in any other nation when the general improvement in all animals marketed is considered, is largely due to the work of the breeders themselves, working through their record associations. Six years ago representatives of a large number of breeders associations met and organized the National Society of Record Associations with the following purposes: "to advance the interest of all registry associations by devising and perfecting practical methods of preserving pedigrees of purebred animals; by united effort endeavouring to secure the enactment of equitable laws relating to record associations; by securing the adoption of just rates by the railroads on exhibition and breeding stocks, and also to do and transact such other business as will, in the judgment of such society, advance the interest of breeders of purebred stock through their respective registry associations".

The data presented by the National Society of Record Associations in Table I, concerning 37 register associations, have reference to the 1915 fiscal year, and were furnished by the officers of the respective associations.

Practically all American associations came into existence between 1875 and 1890, and a large proportion of these became incorporated between 1881 and 1886. Their first duty was to preserve the purity of their breeds, to issue pedigrees for such animals as could present evidence of eligibility and to maintain records of ownership through their transfer records. Their second function was to promote interest in the different breeds by demonstrating in various ways that purebred animals were more valuable from a money standpoint than common animals.

Liberal appropriations were made for prizes at state, interstate and national fairs or exhibitions. This brought the best of the purebred ani-

	Number of Members	Number of breeders record- ing	New Mem- bers during last year	Number of registra- tions last year	Number of trans- fers last year	Approximate amount expense for		
						Special prizes	Field work includ- ing test work	Adver- tising through printed matter
<i>Cattle.</i>						\$	\$	\$
American Shorthorn Breeders' Association. . . . .	800	18 000	—	65 000	7 709	45 000	10 000	13 000
American Hereford Cattle Breeders' Association. . .	6 700	14 000	625	45 000	32 000	41 000	5 000	2 000
American Aberdeen Angus Breeders' Association. . .	3 100	10 000	287	16 274	14 092	15 000	5 000	6 000
American Galloway Breeders' Association. . . . .	410	1 000	12	1 150	610	1 540	—	195
Red Polled Cattle Club of America. . . . .	1 000	1 800	81	3 628	1 669	2 775	—	800
Polled Durham Breeders' Association. . . . .	312	2 500	—	2 267	—	604	—	—
American Guernsey Cattle Club. . . . .	472	5 000	52	11 114	9 036	3 351	2 604	3 500
Holstein Friesian Association of America. . . . .	7 676	23 000	1 345	67 680	66 776	4 807	5 087	21 859
American Jersey Cattle Club. . . . .	554	23 000	43	33 006	30 874	3 940	2 502	13 703
Ayrshire Breeders' Association. . . . .	776	—	106	3 600	3 180	1 636	5 768	664
American Polled Hereford Breeders' Association. . .	506	1 750	106	1 737	973	400	—	600
<i>Horses.</i>								
Percheron Society of America. . . . .	7 336	17 000	916	8 492	6 831	8 618	800	1 294
American Clydesdale Association. . . . .	840	—	150	1 000	950	2 100	—	300
American Association of Importers and Breeders of Belgian Draft Horses. . .	925	—	150	1 128	1 420	3 116	300	149
American Shire Horse Breeders' Association. . . . .	910	410	54	632	478	22 Silver Trophies	—	—
National French Draft Horse Association. . . . .	240	—	—	1 213	574	—	—	—
American Suffolk Horse Association. . . . .	63	121	8	72	38	500	—	225
American Saddle Horse Breeders' Association. . . . .	303	1 800	—	1 475	300	978	250	—
American Shetland Pony Club. . . . .	4 86	250	30	1 109	800	750	—	315
<i>Sheep.</i>								
American Shropshire Registry Association. . . . .	4 715	30	143	15 572	3 858	3 602	716	1 035
American Southdown Breeders' Association. . . . .	357	2 500	12	2 432	1 750	—	—	—

	Number of Mem- bers	Number of breeders reord- ing	New Mem- bers during last year	Number of regis- trations last year	Number of trans- fers last year	Approximate amount expense for		
						Special prizes	Field work includ- ing test work	Adver- tising through printed matter
						\$	\$	\$
American Rambouillet Sheep Breeders' Association . . .	451	650	9	6 000	1 548	—	—	—
American Oxford Down As- sociation . . . . .	504	2 000	16	3 169	700	150	—	—
American Costwold Associa- tion . . . . .	240	350	—	—	—	400	—	100
American Cheviot Sheep So- ciety . . . . .	196	200	11	612	276	—	—	—
Continental Dorset Club . .	183	200	17	1 215	787	500	—	140
American Hampshire Sheep Association . . . . .	851	1 250	54	10 415	2 916	1 000	—	—
National Lincoln Sheep Breed- ers' Association . . . . .	109	122	14	1 650	128	352	—	10
Standard Delaine Merino Sheep Association . . . . .	25	25	—	112	2	—	—	—
<i>Swine.</i>								
American Berkshire Associa- tion . . . . .	642	15 000	192	14 940	14 118	1 700	—	1 795
American Poland China Associa- tion . . . . .	2 535	11 700	76	25 350	—	3 500	2 500	2 000
American Yorkshire Club . .	336	800	14	1 808	175	195	—	157
National Poland-China Re- cord Association . . . . .	885	1 200	36	5 000	500	—	—	—
Standard Poland-China Re- cord Association . . . . .	1 232	10 000	93	22 675	1 000	433	311	99
National Mu'le-Fort Hog Re- cord Association . . . . .	130	5 000	10	1 462	745	—	—	—
National Duroc-Jersey Re- cord Association . . . . .	5 468	10 000	605	35 693	7 000	2 013	—	701
American Duroc-Jersey Swine Breeders' Association . . .	1 700	8 950	287	17 100	17 060	3 200	500	950

imals prominently before the public, where their points of superiority could be studied.

The promoting work done through the agency of prize moneys was soon supplemented by solid arguments regarding the economic advantages of purebred animals over scrubs.

These activities promoted the rapid distribution of purebred stock, and the powerful influence of organized breeders secured legislation more just and more favourable to live stock breeders. In the data presented the



limited number of transfers made by the Shorthorn association is due to the fact that a system of transfers was not inaugurated until March 1915, while nearly all others have required transfers for many years or from the very beginning.

The number of breeders doing business with the associations is vastly greater than the membership.

The number of registrations of horses is much less, in proportion to the number of breeders engaged, than in the cattle associations, as the general use of purebred mares has only recently become widespread, but rapid progress is certain to be made in future.

The record wool and mutton prices have given a new impulse to sheep raising and the hard work done by the sheep breeder's associations in past years will soon bear an abundant harvest.

Pig breeders have probably done more in the work of improving common stock than the breeders of any other species of animals and the thousands of uniform carloads of hogs afford ample evidence of the successful use of purebred boars.

## CATTLE

- 59 - **Milk Production and Age.**—WOODS CHAS. D., in *Special Report of the Maine Agricultural Experiment Station for the Commissioner of Agriculture for the year 1914*. pp. 3-5. Orono, Maine, 1916.

In connection with the studies of the inheritance of milk production, in progress at the Maine Experiment-Station, the problem of correction to apply to milk production records for the changing age of a cow has been studied and tables are being prepared by which it will be possible, knowing a heifer's milk record, to read off her probable production as a mature cow. Furthermore, it will be possible for a dairyman to give each one of his cows an absolute rating in comparison with advanced registry animals of the same breed at any given age. If he will keep a milk record, he can, with the help of these tables, say whether or not a particular cow is better or worse and by what proportion, than the average of advanced registry cows of the same age. The work on Holstein-Friesian and Jersey cattle is now practically completed.

- 60 - **On the Holding up of Milk by Cows** (1).—ZWART S. G., in *Zeitschrift für Fleisch- und Milchhygiene*, Year, 26, No. 24, pp. 373-375. Berlin, Sept. 15, 1916.

After considering the work done on this subject, it is concluded that there are two phases of the phenomenon of the retention of milk by cows, viz : 1) true holding up ; 2) the milk does not flow. These two phases have quite different causes giving the same result, that is, a reduction in the milk produced.

In explaining the first phase, the Author agrees with HESS in that a cow may be frightened during milking by various causes (dogs barking, blows, etc) ; she then holds up her milk and milking is of no avail. The truth of this observation is demonstrated by the fact that on inserting a milking tube in the teat of a cow holding up her milk a certain amount of

milk was obtained. If the stoppage had been caused by the premature interruption of the second phase, milk could still have been obtained. The stoppage of the flow of milk probably originated in the teat.

Regarding the second phase: the cessation of the flow of milk, it does not take place suddenly, but is observable at the beginning of milking. The milking is completed sooner and less milk is obtained. At the end, the teats are flaccid and shrivelled, and no more milk can be obtained with a milking tube. The cause is, in this case, a decrease in milk secretion during the second phase, resulting from some lesion either of the mammary gland nervous system, or possibly other organs, whose pathological state can, by reflex action exert a deleterious action on milk secretion. This condition does not prevent the milking being completed.

**61 - Advances made in 1916 by the Four Leading American Breeds of Dairy Cows.**

— CALDWELL W. H. (Secretary American Guernsey Cattle Club). MACMONNIES W. (Chief Extension Dep. Amer. Jersey Cattle Club). VANDERSLICE J. A. (Holstein Friesian Association). WINSLOW C. M. (Secretary Ayrshire Breeders Association). — *The Field Illustrated*, Vol. XXVI, N° 10, pp. 836-837; New-York, October 1916.

*The Guernsey.* At the last annual meeting of the Guernsey Club the report showed that during the last five years the work of the Guernsey register had increased 139 %. In the first four months of the present fiscal year more than 20 % more sales or transfers of Guernseys have been reported than in the same period of last year, while there has been a noticeable gain in the number of entries. In spite of the disturbing conditions importations numbered 500 head. The number of cows under advanced Register test increased nearly 20 %.

The continued increase in the average yield of both milk and butter fat in the Advanced Register shows that for 5135 cows the average is 8853.84 pounds of milk and 441.49 pounds of butter fat with an average per cent of 49.86.

All over the country the increasing numbers of Guernseys and Guernsay grades is very noticeable.

The readiness with which dairymen are increasing the percentage of their herds with Guernseys shows that the ability of the Guernsey to tone up and color up the products is being more and more appreciated. The natural colour and fine flavour of Guernsey products as well as the ability of the Guernsey cow to produce them most economically is a corner stone for the future of the breed.

*The Jersey.* — To the student of dairy conditions and even to the outsider with only a perfunctory knowledge of breeds and breed politics, the forward movement in Jersey circles within the past year has been very evident, but to one intimately associated with the workings of the club, and familiar with the attitude of the farmers and breeders, it has been remarkable.

Jersey breeders play an active part, with their herds well in the forefront, in the workings of the 360 cow-testing associations of the United-States.

Registration from April 1 to August 1 this year shows an average



gain of 300 per month over a year ago. Because Jersey breeders have always made it a point to keep their stock registered up-to-date, this increase is gratifying. In number of transfers, however, the real activity is displayed. In 1916, 2044 more animals were bought and sold in the five months from April to August, than in the same period in 1915. Jerseys are selling readily and demand for good stock exceeds the supply. Furthermore in this period, April 1 to August 1, 1916, 1996 new breeders began to register and sell stock. These new breeders include only those who have registered stock and are exclusive of those Jersey breeders who have not yet recorded animals of their own breeding. This class constitutes a large percentage of the new breeders, and gives a fair idea of the large number of new Jersey herds being founded.

A marked improvement in the Jersey from the standpoint of type is readily noticed by any one who has attended the fairs and dairy cattle shows. There are more cows of superior quality in the ring to day than there ever were before. In regard to production the past year has witnessed remarkable strides forward.

From January 1 to July 31, 1914, 460 tests were accepted. In the same period in 1915, 779 tests were accepted, and in 1916, 1217 tests, an increase of almost 300 % over the same period in 1914.

*The Black and White.* The growth of the Holstein-Friesian Association and the increase in number of this breed of cattle on American farms is based on the great inherited capacity of milk production.

This capacity has been encreased considerably during the twelve months just passed. *Lutske Vale Cornucopia* made a record of 789.7 pounds of milk and 26.4 pounds of 80 % butter in a period of seven days. A more recent record for fat production in the junior four-year-old class was made by *Queen Piebe Mercedes* which produced in one year 30 230.2 pounds of milk and 1 111.50 pounds of fat, her fat test being 3.68 %. The 1 200 pound mark was passed when *Duchess Skylark Ormsby* made a record of 1 206 pounds of fat, which has not yet been broken. Other great cows in the yearly division were *Ona Button De Kol* 1 076.44 pounds of fat, and *Banostine Belle De Kol* 1 075.44 pounds of fat.

In the seven-day division, the butter record as it stood at the beginning of last year was exceeded eight times. In the senior four-year-old class the record was raised from 29.52 pounds of fat from 575.8 pounds of milk, to 35.536 pounds fat from 721.4 pounds milk.

The amount of testing done during the past year greatly exceeded that of the year before, the increase in the seven-day division amounting to 12.3 per cent, for the eight months 64 %, and the yearly division 32 per cent. Certified reports of official tests covering 141 385 days have been received, verified and accepted, during the fiscal year. The amount of official testing done is equivalent to the testing of 20 198 cows for one week.

Considered as a herd of 11 858 animals, of which over one-half were heifers with first or second calves, the herd produced within a period of seven consecutive days, 4 483 885 pounds of milk containing 170 911.637 pounds fat, thus showing an average of 3.53 per cent fat. The average



production of each animal was 408.1 pounds milk containing 14.401 pounds fat.

*The Ayrshire.* The past year in the Ayrshire world as represented by the Ayrshire Breeders Association, has been an eventful one in the increased membership, the growing volume of registry and transfer applications, and particularly in the Advanced Registry work.

From the beginning of official testing to July 1, 1916, the records of 2 186 cows and heifers have been reported, giving an average annual production of 9 477 pounds of milk and 373 pounds of fat.

This means that Ayrshire milk averages 3.94 % fat, which for the breed as a whole, would mean approximately an average of four per cent fat.

The individual champions in each class that have developed during the past year are :

Mature : Garclaugh May Mischief . . . . .	25329 pounds milk	894.91	pounds fat
	1053 pounds butter	3.53 %	fat
Senior 4 year : August Lassie . . . . .	17784 pounds milk	720.03	pounds fat
	847 pounds butter	4.05 %	fat
Senior 3 year : Lassnessock Buntie . . . . .	15794 pounds milk	548.44	pounds fat
	640 pounds butter	3.47 %	fat
Junior 3 year : Ethel of South Farm . . . . .	15056 pounds milk	589.20	pounds fat
	693 pounds butter	3.91 %	fat
Senior 2 year : Henderson's Dairy Gem . . . . .	17974 pounds milk	738.32	pounds fat
	869 pounds butter	4.11 %	fat
Junior 2 year : Willowenors Etta 3rd . . . . .	16621 pounds milk	666.06	pounds fat
	784 pounds butter	4.01 %	fat

With the rapidity with which new records are made in each class it is quite evident that the limit of Ayrshire production is not reached.

When systematic breeding as well as systematic feeding are adopted, the fame of the Ayrshire as a breed will be fully established.

62 - **The Selection of Dairy Cattle and the Development of Cooperative Associations for the Control of Milk Production in the United States, from 1906 to 1916.** — *Hoard's Dairyman*, Vol. LII, No. 15, p. 509. Fort Atkinson, Nov. 3, 1916.

The movement in favour of cooperative associations of breeders and producers for the control of the individual production of dairy cows, in view of selection, had its origin in Michigan in 1906. In the course of the last ten years this movement has extended to 38 States, and now includes a total of 346 Associations. Appended is a list of the States which possess the largest number of Associations of this type :

Wisconsin . . . . .	52	Pennsylvania . . . . .	19
New York . . . . .	44	Oregon . . . . .	15
Vermont . . . . .	38	Illinois . . . . .	12
Iowa . . . . .	23	Maine . . . . .	11
Minnesota . . . . .	22	New-Hampshire . . . . .	11
Ohio . . . . .	20	Michigan . . . . .	10

The appended Table shows the development of these Societies from the beginning.

*Development of Cooperative Milk Recording Societies in U. S. A.,  
from 1st July 1906 to 1st July 1916.*

States	Number of associations at work in										
	1906	1907	1908	1909	1910	1911	1912	1913	1914	1915	1916
Michigan . . . . .	1	4	2	5	4	3	4	4	3	3	10
Maine . . . . .	—	—	3	4	3	6	5	4	5	8	11
New-York . . . . .	—	—	1	1	3	9	18	21	29	35	47
Vermont . . . . .	—	—	—	2	8	10	11	17	28	33	38
Iowa . . . . .	—	—	—	2	5	4	8	7	8	13	23
California . . . . .	—	—	—	1	3	2	4	4	5	7	9
Wisconsin . . . . .	—	—	—	9	10	10	8	11	24	37	52
Nebraska . . . . .	—	—	—	1	0	0	0	3	2	3	4
Colorado . . . . .	—	—	—	—	1	1	2	1	1	0	0
Pennsylvania . . . . .	—	—	—	—	1	1	2	2	7	14	19
Ohio . . . . .	—	—	—	—	1	0	0	1	4	5	20
Maryland . . . . .	—	—	—	—	—	1	3	3	2	4	7
Illinois . . . . .	—	—	—	—	—	4	3	2	7	3	3
Washington . . . . .	—	—	—	—	1	3	1	0	0	1	12
Minnesota . . . . .	—	—	—	—	—	3	7	10	9	11	22
New-Hampshire . . . . .	—	—	—	—	—	1	1	1	4	8	11
Oregon . . . . .	—	—	—	—	—	1	1	1	7	11	15
Utah . . . . .	—	—	—	—	—	1	0	0	1	1	0
Massachusetts . . . . .	—	—	—	—	—	2	2	2	3	0	4
Virginia . . . . .	—	—	—	—	—	2	2	2	0	0	2
Kansas . . . . .	—	—	—	—	—	—	1	1	1	0	1
Indiana . . . . .	—	—	—	—	—	—	2	2	2	3	7
Kentucky . . . . .	—	—	—	—	—	—	1	1	1	0	1
Missouri . . . . .	—	—	—	—	—	—	—	—	2	1	2
New-Jersey . . . . .	—	—	—	—	—	—	—	—	2	3	4
West Virginia . . . . .	—	—	—	—	—	—	—	—	1	1	3
Connecticut . . . . .	—	—	—	—	—	—	—	—	1	3	6
N. Carolina . . . . .	—	—	—	—	—	—	—	—	2	0	0
Louisiana . . . . .	—	—	—	—	—	—	—	—	1	0	0
S. Dakota . . . . .	—	—	—	—	—	—	—	—	1	1	3
Nevada . . . . .	—	—	—	—	—	—	—	—	—	1	0
Arizona . . . . .	—	—	—	—	—	—	—	—	—	—	2
Rhode-Island . . . . .	—	—	—	—	—	—	—	—	—	—	2
Delaware . . . . .	—	—	—	—	—	—	—	—	—	—	2
Idaho . . . . .	—	—	—	—	—	—	—	—	—	—	2
Mississippi . . . . .	—	—	—	—	—	—	—	—	—	—	1
Montana . . . . .	—	—	—	—	—	—	—	—	—	—	1
Tennessee . . . . .	—	—	—	—	—	—	—	—	—	—	1
Totals . . . . .	1	4	6	25	40	64	62	100	163	210	346

63 - **The Numbers of Purebred Schwiz and Simmenthal Cattle belonging to the Breeders' Societies in Switzerland on January 1st, 1916.** — *Landwirtschaftliches Jahrbuch der Schweiz*, Year 30, Part 4, pp. 385-438. Berne, 1916.

The pure-bred Schwiz and Simmenthal cattle existing in Switzerland on January 1st 1916, and registered in the herd books, included the total of 1444 bulls and 51,806 cows, divided as follows: 384 bulls and 21 971 cows of the Schwiz breed: 1096 bulls and 29 835 cows of the Simmenthal breed.

The following table shows: the number of breeders' Societies existing in the various Swiss cantons on January 1st, 1916, as well as the number of members — the number of bulls and cows entered in the herd books of the various Societies on the same date.

*Condition of the Cooperative Societies of Breeders of pure Schwiz and Simmenthal cattle, and the total head of cattle on Jan 1st 1916.*

Schwiz Breed					Simmenthal Breed				
Cantons	Breeders' Societies		Cattle		Cantons	Breeders' Societies		Cattle	
	Number of Societies	Number of members	Number of Bulls	Number of Cows.		Number of Societies	Number of members	Number of Bulls	Number of Cows.
Zurich . . . . .	45	2418	85	5 176	Berne . . . . .	90	1 838	235	10 093
Schwiz . . . . .	30	636	63	3 840	Fribourg . . . . .	56	5 318	154	7 154
Grisons . . . . .	25	546	39	2 655	Vaud . . . . .	131	1 253	534	6 857
Lucerne . . . . .	12	440	38	1 979	Soleure . . . . .	16	302	29	1 378
Zug . . . . .	9	294	24	1 357	Argovie . . . . .	14	616	24	1 217
Thurgovie . . . . .	14	334	20	1 085	Lucerne . . . . .	11	274	24	1 106
Glaris . . . . .	9	411	10	987	Neuchâtel . . . . .	8	319	11	810
Appenzell Rhodes Ext. .	10	323	12	984	Geneva . . . . .	18	477	65	697
Argovie . . . . .	6	229	13	899	Basel-country . . . . .	8	234	17	432
Obwalden . . . . .	5	139	8	700	Basel-town . . . . .	1	24	3	91
St Gall . . . . .	6	165	10	631					
Nidwalden . . . . .	6	74	11	576					
Uri . . . . .	5	96	7	441					
Appenzell Rhodes Int. .	3	72	4	374					
Berne . . . . .	3	119	4	287					

64 - **Karakul Sheep Breeding in South Africa.** — (1) HOLM ALEX, (Under-Secretary of Agriculture) in *The Agricultural Journal and Small-Holder of South Africa*, Vol. III, No. 18, pp. 168-174. Johannesburg, June 1916.

Karakul sheep produce the lambskins from which astrakan fur is made, their original habitat being Bokhara and surrounding districts, in Russian Turkestan, between the Caspian Sea and Northern Afghanistan.

(1) See B. 1911, No. 2771; B. March 1913 No. 282; B. Jan. 1914 No. 2; B. June 1916, No. 668,



The climate is very dry; hot in the summer, while in the winter intense cold is experienced.

The Karakul sheep have therefore acquired great hardihood and are capable of subsisting on the scantiest fare.

In many respects the conditions of their natural habitat are not dissimilar to large areas of the Union and of South-West Africa, where the Afrikander breed of sheep thrives.

In conformation the Karakul resembles the Afrikander, though it is generally rather larger. It is essentially a hairy sheep. In the adult the hair, which with age turns from black to greyish black, attains a length of 4 to 6 inches. The lambs have a more or less lustrous black hair, in form of curls or locks, which open out at periods varying as a rule from three to nine days. Brown, greyish and greyish-black born lambs are regarded as "fancy".

The great importance of the fur industry has induced Governments and individuals in different countries to introduce Karakul sheep therein. Russia, Austria, Canada, Great Britain, Germany, South West Africa made importations of pure-bred Karakul sheep.

The largest exportations of Karakul, outside of Europe, have been made to South-West Africa, where in 1912 there were 341 pure bred animals and 37.53 halfbred. Quite recently 84 of these ewes and three rams have been transferred to the School of Agriculture, Grootfontein Middeburg C. P. in the Union of South Africa. The surplus rams, 49 head, were sold by auction by the Protectorate Administration in October and November last and the average price of £ 22 was realised. Experiments were conducted by the German Government on crossing Karakul rams with Afrikander, Persian, Merino and a few Heidschuhen (German breed) ewes. The best results have been obtained from the Afrikander. The crosses from the Merino and Heidschuhen were unsatisfactory. Experience shows that the skins of half bred lambs are seldom of sufficient quality for marketing, but that a fair proportion of three-quarters and seven-eighths bred skins are of good quality.

MR. TEINERT states that after being tanned and dressed the three-quarters bred skins, in the first consignment exported by him, realised from 12s. to 45 s. each and that the average price of the entire shipment was 32s. per skin. DR GOLF records that 4s. to 8s. each was obtained for half-bred skins from South-West Africa and the late PROF. KUHN stated that his three-quarters and seven-eighths bred skins were valued at 20s. to 30s. each. The report made by M. KARPOV to the Russian Government states that from the Khanate of Bokhara there are exported  $1\frac{1}{5}$  th. to  $1\frac{1}{2}$  million skins per annum, valued at nearly £ 1 000 000 and that there has been a steady advance in prices for the last 20 years, amounting to 180 %. The chief markets for the raw undyed skins are Nijni-Novgorod and Moscow. The dyeing process has been chiefly done at Leipzig, where about 385 000 skins are handled annually.

Karakul sheep are able to maintain themselves in satisfactory breeding condition on poor and scanty herbage and it has been shown that they

are unsuited to countries possessing damp climates. The ewes breed regularly and generally have only one lamb at each parturition. In Bokhara in certain seasons they suffer from a disease called "djuct", and their lambs are born prematurely. The pelts from these lambs are classified as "broadtail" fur and often fetch much higher prices than the ordinary skin. There is no evidence to support the statement that ewes are killed in order to procure skins of this class.

The lambs reach their highest quality for fur purposes, as a rule, in from three to eight days after birth. The period of maturity of the skin varies with each lamb, and within a day or two after the locks have reached the desired development the quality deteriorates.

In order to maintain or increase the number of the flocks the sales of skins should be confined almost entirely to the male lambs.

South Africa has in large numbers the most suitable foundation stock for grading up, as in the Afrikaner there is a large available supply of ewes, which can be obtained at comparatively low prices..

But apart from the question of production of Karakul skins, there is evidence to show that the mutton producing qualities of the Afrikaner would be improved by the introduction of Karakul blood. The Karakul is rather larger than the Afrikaner and the crosses give greater weights of carcase. There would be no depreciation in quality of mutton as Karakul mutton is renowned for its quality. It may therefore be emphasised that even if at any time the skins do not meet a good trade there would be no reduction but rather an improvement in the value of the flock for mutton production, while on account of the hardihood of the Karakul and its suitability to dry desert conditions, the cross-bred or grade flock would be equally as hardy as the Afrikaner. Again in the process of grading up, those lambs whose skins are not of sufficient quality for the fur trade will be retained for slaughter stock, and no depreciation in value, as compared with the Afrikaner, will result. The hairy "fleece" of the Karakul is worth about 4 d. per lb. and the return per head per annum from this source is from 1s 6 d. to 2s. When the lambs are killed at a few days old less difficulty should be experienced in maintaining ewes in good breeding condition, particularly during a severe drought; the ewes under these conditions should give birth to a large number of lambs within a given time and losses among lambs in unfavourable seasons would be reduced.

In the areas where conditions are unfavourable to the Merino, the infusion of Karakul blood on the Afrikaner stock is likely to be profitable both from the point of view of mutton production and a potential fur industry. In the case of the latter, consistent grading up with pure-bred Karakul rams will require to be practised.

Those who may be disposed to buy Karakul sheep or their crosses, are advised to exercise the greatest circumspection, as the three-quarters and seven eighths bred sheep are not easily distinguished from the pure bred.

It is matter of first importance to ascertain, if possible, points in the adult which are correlative with quality of fur in the lamb. On a close inspection on the rams and ewes and their lambs in the flock of South-West



Africa, certain points were noted which are likely to prove helpful in determining these correlative features. In the ram and ewe there should be an absence of soft "tight" wool next to the skin. The hair should be strong, dense and curly, or crimped near the skin, which should be black. It would appear that lustre in the lamb is correlative with the lustre on the short black hair of the face, the ears and the legs of the ram and ewe.

Lambs which develop their highest quality of fur at, say, a week or more old would, on the average, be larger than those which attain their maximum quality at, say, three days old, so that the lateness in maturing would be an important and valuable quality. Again, skins are found which are good in parts but are deficient in others. Experiments hitherto made indicate that the best results in crossing or grading up are obtained with the Afrikaner ewe, but of Afrikaner there exist several types in South Africa. The best type has still to be determined, but it seems reasonable to suppose that the short glossy or lustrous haired Afrikaner would be the most suitable.

It is the intention of the Department of Agriculture, with the Karakul flocks now in its possession or under the control of the Protectorate of South-West Africa, to make a close study of these points, and a good deal of interesting and valuable information should soon be obtained.

65 - **Experiments in Feeding Maize Silage to Lambs at the South Dakota Experiment Station, U. S. A.**—WILSON JAMES W., in *Dept. of Husbandry, South Dakota State College of Agriculture and Mechanic Arts. Bulletin* N° 165, pp. 377-390, 7 fig. Huron, S. D., April 1916.

The above bulletin includes the results of two experiments in feeding maize silage to lambs. It also includes results of other experiments in feeding lambs reported in previous bulletins now out of print.

Lambs turned on the stubble, after the grain is harvested and stacked, provided rape has been sown with the grain, will make a big gain and the manure will be scattered evenly over the field. In the course of experiments made in 1908 and 1909 the average daily gain per head when the lambs received rape pasture alone was 0.34 of a pound, or a larger gain than is usually made when lambs are receiving a full feed of grain and hay.

The best gains ever secured at the Station were obtained in the course of an experiment to determine the comparative value of alfalfa and prairie hay, with the same kind of a grain ration, for the production of a pound of gain. The grain ration consisted of a mixture of 100 lbs. of oats, 100 lbs. of maize grain and 25 lbs. of oilmeal. Each lot was started on one pound per head of the mixture daily, and increased until they were receiving two-tenths pounds per head of grain daily, and what hay they would eat. The average gain per head daily for the lot that received the alfalfa hay was 0.51 of a pound, while with the lot that received the lucerne hay the average daily gain per head was 0.38 of a pound. The lambs were as near the same in weight and age as was possible to get them.

Experience teaches that it pays to let the lambs pick a field of maize; in fact they pick it much cleaner than is done by the average picker.



## Results of the Experiments in Fattening Lambs.

	Lot I	Lot II	Lot III	Lot IV	Lot V	Lot VI	Lot VII
<i>Average ration during the 2 years of the experiment (per head and per day):</i>							
Maize silage . . . . .	1.38 lb.	0.72 lb.	0.60 lb.	0.49 lb.	0.37 lb.	0.22 lb.	—
Grain . . . . .	1.15 lb.	1.52 lb.	1.52 lb.	1.49 lb.	1.51 lb.	1.52 lb.	1.51 lb.
Hay . . . . .	—	0.76 lb.	0.86 lb.	0.97 lb.	1.23 lb.	1.33 lb.	1.11 lb.
<i>Results in 1914:</i>							
Average weight at beginning . . . . .	74 lb.	72 lb.	72 lb.	72 lb.	72 lb.	72 lb.	72 lb.
Average weight at close . . . . .	85 lb.	92 lb.	96 lb.	96 lb.	93 lb.	95 lb.	95 lb.
Average gain per head daily (87 days) . . . . .	0.13 lb.	0.23 lb.	0.28 lb.	0.28 lb.	0.25 lb.	0.24 lb.	0.23 lb.
Cost of producing 100 lb. gain. . . . .	\$ 11.44	\$ 8.45	\$ 7.12	\$ 7.09	\$ 7.96	\$ 7.21	\$ 7.45
<i>Results in 1915:</i>							
Average weight at beginning . . . . .	80 lb.	32 lb.	77 lb.	74 lb.	80 lb.	81 lb.	78 lb.
Average weight at close . . . . .	85 lb.	93 lb.	91 lb.	86 lb.	92 lb.	92 lb.	88 lb.
Average gain per head daily (60 days) . . . . .	0.08 lb.	0.18 lb.	0.23 lb.	0.21 lb.	0.19 lb.	0.17 lb.	0.16 lb.
Cost of producing 100 lb. gain. . . . .	\$ 12.00	\$ 9.69	\$ 7.83	\$ 8.39	\$ 9.23	\$ 10.40	\$ 10.47

## Price of feeds taken as basis of calculation:

Grain . . . . .	1 cent. per lb.
Maize silage . . . . .	\$ 3 per ton.
Prairie hay. . . . .	\$ 6 per ton.

Then too, they will eat the husks and leaves of the maize and nearly all the weeds that have gone to seed. They will clean up the borders of the field that would otherwise remain foul year after year. Sheep prefer the grain in its natural condition and it should be so fed, unless in case of a grain like millet seed when it should be ground coarsely.

The object of later experiments, carried out in 1914 and 1915, was to ascertain to what extent maize silage could be added to the lamb's ration for the best results in fattening. (In previous experiments maize silage had given excellent results with cattle, giving an economic increase in live weight preparatory to fattening). There were 140 lambs used in these experiments, or, in each season, 7 lots of 10 each. Each year lot I was fed maize silage as the sole roughage. Each lot received the same grain ration, consisting of maize and oats mixed half and half by weight. Lots II to VI inclusive were fed silage and prairie hay, with their grain rations, in varying quantities; while lot VII only received hay with their grain rations. The results are summarised in the adjoining Table.

The results show that maize silage is not suitable as the sole roughage ration for fattening lambs with grain. On the other hand, by adding a small quantity of maize silage to the lamb's ration, more uniform and larger gains were made than with lambs not receiving any maize silage.

In lot III which gave the most uniform and economic increases in live weight. A mixture of oats and maize, half and half by weight, is not a good ration for fattening lambs.

## PIGS

66 - **Relation of Fertility to Length of Body in Brood Sows.** — WENTWORTH E. N., (Kansas Agricultural College) in *The Breeder's Gazette*, Vol. LXX, No. 12, pp. 470-471. Chicago, September 21, 1916.

Some interesting figures on the relation of fertility to length of body have been collected on the herd of brood sows last spring at the Kansas Agricultural College. Ten large-type Poland-China, 2 Berkshires and 16 Duroc-Jersey sows were included in the figures. The sows were divided into 6 grades — very long, long, medium long, medium short, short and very short. No sow was included in the last category as definite selection had been practiced in the herd against short-bodied animals. Twenty-one of the sows were in the three long grades and seven were in the two short grades remaining.

The following table shows the results from the five different grades, although the numbers in some of the grades are relatively small.

The litter of 20 pigs, of which only 4 survived, can scarcely be charged against the Duroc-Jersey sow that produced them, an abnormal parturition having occurred. If this sow is omitted from the count, the averages would almost indicate that it is wisest to select from the short sows, both for large litters and for ability to raise the litter. However, the numbers are too small to draw positive conclusions.

The 2 Berkshire sows raised every pig, but the average litter was only 6. The 10 Poland China produced an average litter of 8.8 pigs, of which 72.7 per cent. or 6.4 pigs, were raised. The 16 Duroc-Jersey sows farrowed 9.93 pigs, and weaned 6.06 pigs, or 61 per cent. If the abnormal Duroc-

*Number of Litters, Average Size and Number Raised by Breeds.*

Breed	No.	Size	Raised	No.	Size	Raised	No.	Size	Raised	No.	Size	Raised	No.	Size	Raised
Poland China . .	1	7	5	1	10.67	7	4	7.75	5.75	2	9	7.5	—	—	—
Berkshire . .	—	—	—	1	4	4	—	—	—	—	—	—	1	8	8
Duroc-Jersey . . .	1	20	4	8	9	5.9	3	9.33	5.33	1	10	3	3	10	9.5
All . . . .	2	13.5	4.5	12	9	6	7	8.43	5.59	3	9.33	6	4	9.25	8.75

Jersey litter is omitted the average litter is 9.27, the number raised is 6.2 and the percentage is 66.9.

It is not assumed that these results are characteristic of the different breeds but their individual records are presented so as to show what of the differences related to length of body may be due to breed.

It does not seem as though breed variations in this study affected the litter size when computed on the basis of body length, while it is quite evident that body length has little to do with the number farrowed.

One cannot say that a medium to short body is desirable as a result of this study, but one can suspect that body length is unrelated to fertility. This does not agree with practical experience, but from other studies it appears that these beliefs of experience were perhaps arrived at on rather incomplete evidence.

67 - **Studies on the Physiology of Reproduction in the Domestic Fowl: Dwarf Eggs** (1). — PEARL RAYMOND and CURTIS, MAYNIE R., in *Journal of Agricultural Research*, Vol. VI, No. 25, pp. 977-1042 + Pl. CXII-CXIII, Washington, September 18, 1916.

POULTRY

Researches carried out in the Biological Laboratory of the Maine Agricultural Experiment Station, United States.

Eggs much smaller than normal eggs are occasionally produced by domestic fowl of all breeds. These eggs usually contain little or no yolk, but occasionally a small yolk, usually unfertile but inclosed in a complete vitelline membrane. The albumen is small in amount, and often, but not always it is of a thicker consistency than the albumen of ordinary eggs. The egg membranes are normal. The shells varies in thickness over the same range as the shells of normal eggs. Sometimes it is entirely lacking, and then the egg is simply covered with a membrane. The writers suggest the name dwarf eggs for these small eggs. Among the various types of abnormal eggs produced by the domestic fowl, the dwarf egg is more common than any other type, except the double-yolked egg. In their article the writers describe:

(1) See also *B. Jan.* 1915, Nos 75 and 76.

(Ed.)



- 1) The different types of dwarf eggs, both as regards shape and contents.
- 2) Their variation in size and shape.
- 3) The interrelations of the variations in dimensions, shape and size.
- 4) The frequency of the occurrence of dwarf egg compared to normal eggs and of dwarf egg producers compared to birds which do not lay dwarf eggs.
- 5) The seasonal distribution of dwarf eggs.
- 6) Dwarf egg production by fowls with normal and with pathological oviducts.
- 7) The relation of dwarf egg production by normal fowls to the age of the fowl, and the position of the egg in the litter and clutch.
- 7) The physiological conditions leading to dwarf egg production.
- 9) The relation of dwarf egg production to other abnormal phenomena of reproduction which occur in nature, or have been experimentally produced.
- 10) The contribution which the study of the physiology of the production of dwarf eggs makes to our knowledge of the normal physiology of egg production.

The results of this study are summarised by the writers as follows:

- 1) During the 8 years from February 1, 1908 to February 1, 1916, 298 dwarf eggs are known to have been produced at the poultry plant of the Maine Experiment Station (most of the fowls kept being Barred Plymouth Rocks).
- 2) During the 2 years of maximum dwarf egg production, the ratio of dwarf eggs to normal eggs was 1 dwarf egg to 1.158 normal eggs.
- 3) Dwarf eggs are of two distinct types in respect to shape, namely prolate-spheroidal, or oval, resembling an ordinary egg, but with the long axis proportionately short, or else cylindrical, with the long axis proportionally longer than in the normal egg.
- 4) Dwarf eggs of the prolate-spheroidal type are much more frequently produced than cylindrical eggs; in fact, 95.4 per cent of the dwarf egg studied were of the first type.
- 5) Dwarf eggs may also be classified according to the absence of yolk, or its presence either as a small yolk in a yolk membrane, or as free yolk.
- 6) Of the 274 dwarf eggs opened, 35.03 per cent were yolkless and 64.96 per cent, or nearly  $\frac{2}{3}$ , contained yolk. The yolk was inclosed in membrane in only 9.85 per cent of the dwarf eggs opened, while free yolk was present in 55.11 per cent of these eggs.
- 7) Dwarf eggs with small yolks, while distinctly smaller than normal eggs, are significantly larger than dwarf eggs with little or no yolk.
- 8) A comparison of the relative size of the several groups of dwarf eggs, normal eggs, double-yolked and triple yolked eggs furnishes a continuous line of evidence that the amount of albumen secreted depends, to a large extent at least, upon the degree of immediate stimulation due to the amount of yolk present.

9) Although the evidence available is not sufficient for a positive statement, the shape of the cylindrical egg is probably due to the long form of the stimulating nucleus.

10) Dwarf eggs with small yolks have indices (measurements of the short axis expressed in percentages of the long axis) which are higher than those for normal eggs and lower than those for other prolate-spheroidal dwarf eggs. This difference in index in the three groups is the reverse of their difference in size.

11) This negative correlation between the shape, index and size extends the evidence from former researches, that the smaller the egg, the broader it is in proportion to its length.

12) Two factors may be involved in producing this negative correlation between index and size : a) The area of the glandular mucosa under stimulation must always be related to the size, particularly the length, of the stimulating nucleus (yolk drop, normal yolk, or two or three yolks in tandem) : b) the oviduct, which is a tube with elastic walls, will offer more resistance to the passage of a large than a small body, and therefore when the plastic egg is forced through it by peristalsis, it will exert a greater elongating pressure upon a large than a small egg.

13) Dwarf eggs of every class are exceedingly variable when compared to normal eggs. This greater variation occurs in all the physical characters measures — length, breadth, shape, index, egg weight, yolk weight, shell weight and, possibly, albumen weight.

14) Dwarf eggs with small yolk resemble normal eggs in degree of variability, as well as in size and shape, more nearly than do other classes of dwarf eggs.

15) The several size characters show different degrees of variation. They may be arranged from most to least variable as follows : egg weight, length and breadth. This arrangement is the same for dwarf and normal eggs.

16) It is probable that the variation in yolk weight compared to the variation in the other egg parts and to the whole egg is greater in dwarf eggs with small yolks than in normal eggs.

17) The interrelation of the size and shape characters in prolate-spheroidal dwarf eggs of each class is as follows : a) Length and breadth, length and weight, and breadth and weight are significantly highly correlated in eggs of each group : b) Index and weight are negatively correlated. The correlation is significant for dwarf eggs with little or no yolk : c) In dwarf eggs with small yolks, yolk weight is highly correlated both with egg weight and with albumen weight. The writers discuss the physiological significance of these correlations.

18) From 1908-1916, 5.15 per cent. of all the fowls kept at the Maine Agricultural Station are known to have produced at least one dwarf egg.

19) Both the actual dwarf egg production and the number of dwarf eggs per 1000 eggs is lowest during the winter months. It increases through the spring, reaching a maximum in the early summer.

20) In general, the season of high normal egg production is also the



season for high dwarf egg production both actual and relative to normal egg production. The maximum of dwarf egg production, however, occurs later in the season than the maximum normal egg production.

21) The production of a dwarf egg is usually an isolated phenomenon occurring only once or twice during the life of a bird. Only 3.5 per cent of the fowls which produced one or more dwarf eggs produced more than 2.

22) A study of all the egg records and the available autopsy records for fowls which produced one or more dwarf eggs shows that in most cases the disturbance which caused the production of the dwarf egg was of temporary character, and was not correlated with a morphological disturbance of the sex organs.

23) Of the 200 dwarf egg producers 11, however, showed evidence that a permanent disturbance had occurred. In these cases, few or no normal eggs were produced after the dwarf egg, or eggs, although nesting records indicate that the ovary passed through normal reproductive cycles.

24) Autopsies were made on 5 of these cases, and all of them showed some pathological condition of the oviduct which interfered with the passage of the egg, but did not entirely close the duct.

25) In normal birds dwarf egg production is most likely to occur during the height of the breeding season. It is not associated with immaturity of the sex organs.

26) The popular notion that a dwarf egg marks the end of a period of production is without foundation. A dwarf egg is equally likely to occur at any time during a clutch or litter.

27) A dwarf egg may be overtaken by a normal egg and form one of the components of a compound egg similar to a double-yolked egg, except that one part is a dwarf egg.

28) A dwarf egg after it has received its membrane, or its membrane and shell, may be returned up the duct, and be included in the succeeding normal egg, or it may act as the stimulus for the formation of a larger inclosing dwarf egg.

29) Dwarf eggs are produced only when the ovary is in the absolutely active condition associated with the maturing of yolks. This is true whether the fowl has a normal or pathological oviduct.

30) When the sex organs are in these conditions, a mechanical stimulation of the oviduct by an artificial yolk may result in the formation of a complete set of egg envelopes.

31) The mechanical stimulation need not begin at the funnel in order to be effective to the parts lower down.

32) The mechanical stimulation is local in its effect, that is, it is not transmitted down the duct below the point to which it is applied.

33) Dwarf eggs may be, and probably are, often produced by the stimulation of an active duct by some material particle which is not yolk.

34) At least 65 per cent of the dwarf eggs studied, however, were initiated by an abnormal small yolk, or by a part of normal yolk. Certainly in some, and probably in all the latter cases, the rest of the yolk was absorbed by the visceral peritoneum.



35) Neither the absolute time relation between ovulation and the ability of the duct to respond to mechanical stimulus, nor the nature of the connection between the state of the ovary and the duct is certainly known.

36) It is suggested that the oviduct may be sensitised by some changes in the internal secretion of the ovary associated with the maturation of yolks. If this is the case, the change in the secretion probably precedes ovulation.

The article is followed by a bibliography of 29 publications.

- 68 - *Trigona williana* and *Trigona amalthea*, Wild Bees attacking the Hive Bee in the Amazon Region, Brazil. — VAN EMMLEN AMARO, in *Chacaras e Quintaes* Vol. XIV, N° 4, pp. 758-759, 1 Fig, San Paulo, October 15, 1916.

BEEES

The Director of the Agricultural Experiment Station of Cachoeira Grande, in the Amazon Region, has sent to the Author specimens of *Trigona amalthea* Oliv. and *T. williana* Friese, which have completely destroyed the hives of *Apis mellifica* belonging to the Station.

The author describes these two enemies of the hive bee and recalls that a few years ago he had attempted to introduce the breeding of *Apis ligustica* (Italian bee) and of *Melipona* sp. ("Mandaca" bee) into Ceara, but the *Trigona* exterminated the swarms of the two species in spite of preventive measures (destruction of the nests of the enemy insects).

- 69 - The Results of Summer Rearing of Silkworms obtained in Piedmont in 1916. — FAVERO P., in *Giornale di Agricoltura della Domenica*, Year XXVI, No. 47, p. 381. Piacenza, Nov. 19, 1916.

SERICULTURE

By request of the "Associazione serica e bacologica" (Silk Association) of Piedmont, the writer has collected the results of summer breeding of silkworms obtained in 1916 in that district. As a whole, these results seem to show that, of the two second rearings, the summer one (mid-July to mid-August) and the autumn one (August, September and sometimes October also), the first is best suited to Piedmont, as autumn rearing presents the following difficulties: 1) there may be lack of mulberry leaves owing to white frosts or early cold; 2) even with a normal temperature, the leaves soon wither, being old; 3) in vineyards on the level and still more in hill side vineyards the most busy time in rearing corresponds with vintage time and the sowing of winter cereals; 4) artificial heating is necessary, which increases the cost, by no means a small item. On the other hand, with summer rearing the mulberry trees are at their best state of vegetation, having fresh and still tender leaves. Again, at this time there is little other work to be done in the country. If it is carried out rationally, and special attention is paid to the ventilation of the silkworm nursery, summer rearing will give good technical results.

The larvae hatch healthily, they eat the mulberry leaves even if hard, except during the first two stages, during which it is absolutely necessary to give tender leaves, which they eat greedily.

Their different stages are shorter, especially as regards the moult; they grow under the best conditions and produce a compact cocoon, rich in silk

and fine grained. The leaves being drier and the rearing being shorter, generally there is obtained a unit yield per ounce little inferior to that obtained by spring rearing and which can be estimated at 50 kg. per ounce, but which may reach 60 kg. and even more if the rearing is properly carried out. Cocoons obtained by summer rearing fetch slightly more than the spring cocoons.

#### RESULTS OF REARING $\frac{1}{3}$ OUNCE IN A ROOM IN TURIN.

*Emergences of larvae*: August 10, regular, in 2 days.

*Growth*: September 15, regular somewhat slow.

*Temperature*: 17 to 22° C: windows always open day and night.

*Condition of larvae*: excellent; no disease; somewhat slow, but this is due to rearing crosses.

*Kind of eggs*: Chinese double-yellow, Maieila female, Chinese gold male.

*Number of cocoons required to make 1 kg. days after full growth of the larvae (this time is needed to ripen the cocoons)*: 600.

*Doubles (or dead cocoons)*: 3%; waste: 1.25%.

*Number of eggs in 1 gm. Weight*: about 1365.

*Percentage of unhatched eggs*: 2%.

*Yield in cocoons from 10 gm. of eggs*: 22 kg.

*Price obtained for the cocoons*: 6 fr. a kg.

The writer concludes that it would be profitable to summer-rear amounts equal to  $\frac{1}{4}$  or  $\frac{1}{5}$  of those reared in spring, very much divided, but very numerous.

#### YIELD AND QUALITY OF THE SILK (TEST BY THE SILK LABORATORY, MILAN).

<i>Average weight of a cocoon</i> . . . . .	1.67 gr
" length " " " . . . . .	28.80 mm
" breadth " " " . . . . .	19.70 mm
<i>Relation between silk cocoon and pupa</i> ; alive, average . . . . .	100 : 106
" " " " " " ; dried, average . . . . .	100 : 147.2
<i>Average loss in degumming</i> . . . . .	26.02 %
<i>Average length of loose outer silk</i> . . . . .	740 in
<i>Average standard of loose outer silk</i> . . . . .	2 881 legal deniers
<i>Average elasticity of raw silk</i> . . . . .	220.15 mm.
<i>Average tenacity of raw silk</i> . . . . .	40.22 gr
<i>Average standard of raw silk</i> . . . . .	10.42 deniers
<i>Tenacity of raw silk, per denier</i> . . . . .	3.862 gr
<i>Loss of raw silk in degumming</i> . . . . .	23.44 %
<i>Loss of loose outer silk in degumming</i> . . . . .	21.13 %
<i>Loose outer silk per 100 of silk</i> . . . . .	27.928 %
<i>Ash of silk</i> . . . . .	0.809 %
<i>Spinning of Silk, with 3 new cocoons or 4 mixed, with 4 ends—</i>	
<i>water temperature</i> : in the basin: 60°C; in the beater: 95°C.—	
<i>speed of divider</i> : 125 meters per minute; <i>turns of barrel in beater</i> :	
7; <i>Yield (weight of cocoons necessary to yield 1 kg. of silk) on</i>	
<i>an average</i> . . . . .	9 kg.

Advice is given as to the technique of this rearing and the utilisation of the mulberry leaves for this purpose. It is advised to give leaves and

finest branches immediately after the second moult: to use for summer rearing those trees that have not been defoliated in spring and which have been touched by spring frosts but have formed new foliage; also those that are to rest for winter pruning; those to be rejuvenated by pruning, or as is more usual, by removing the interior leaves of the crown of those trees that had been used for spring rearing, or by defoliating one out of every three branches. The trees that have been partly defoliated in summer or autumn should be manured and freed from mosses, lichens, etc. In experiments made by the author it was shown that removing  $\frac{1}{6}$  to  $\frac{1}{4}$  of the foliage in summer causes no injury to the trees; moreover, it is an advantage, for air and light penetrate more easily into the less dense foliage.

- 70 - On the Spawning Migration of the Lake Trout (*Salmo fario lacustris* L.). — ROULE LOUIS, in *Comptes Rendus des Séances de l'Académie des Sciences*, 1916, Second Half-Year, Vol. 163, N° 19, pp. 527-529, Paris, 1916.

FISH  
CULTURE.

The Author has extended his previous researches on the spawning migration of the salmon (*Salmo salar* L.) (1) so as to include other species. Lake trout rarely spawn in lakes themselves, but find their way up tributary streams. The author's observations bear on the lake trout of Lake Lemman and Lake Nantua, and were carried out in August 1916; those in Lake Nantua were the most characteristic. Lake Nantua has two principal tributaries: the Merloz, which the trout ascend for spawning, and the Doye, which presents no migration. The volume of dissolved oxygen in these waters was found to be:

*In the Lake itself*: 6.8 to 6.9 cc. in the superficial layers (temperature = 19.1° to 20.5° C.); 6.5 cc. at 10 m. deep. (temperature = 11.9° C).

*In the Merloz*: 7.4 cc. (temperature of 11.9° C).

*In the Doye*: 5.8 cc. (temperature of 12.2° C).

Thus the trout pass from a region poor in oxygen to a richer one. This fact may be of practical importance. In fact, the Administration of Waters and Forests has established a station on the Merloz in order to capture the breeding-fish at the time of their ascent and to carry out artificial fertilisation, so as to obtain eggs and fry for the purpose of restocking. This initiative deserves to be followed, by using the tributary containing the largest volume of dissolved oxygen, for in that tributary are found the most numerous and healthy breeding fish.

- 71 - The Activity of Nitrogen-fixing Bacteria in Fish Ponds. — See No. 12 of this *Bulletin*.

## FARM ENGINEERING.

- 72 - A New Device to Increase the Power of Tractors. — *Le Génie rural*, Year 8, No. 64, pp. 10-11, 2 fig. Paris, October 1916.

AGRICULTURAL  
MACHINERY  
AND  
IMPLEMENTS

This device, designed by MM. MISTRAL and BROCHE has the object, with the help of an aerohydraulic-transformer of mechanical couples, of using

(1) See B., May, 1916 N° 543.

(Ed.)



internal-combustion engines of a power practically equal to the normal work to be done by the machine. For this purpose the "resistance" of the couple, practically equal to the "power" represented by the normal power of the motor, is divided into two groups: one represented by the mechanism serving to move the machine, the other by the mechanism or implements serv-

*Device for increasing the power of tractors.*

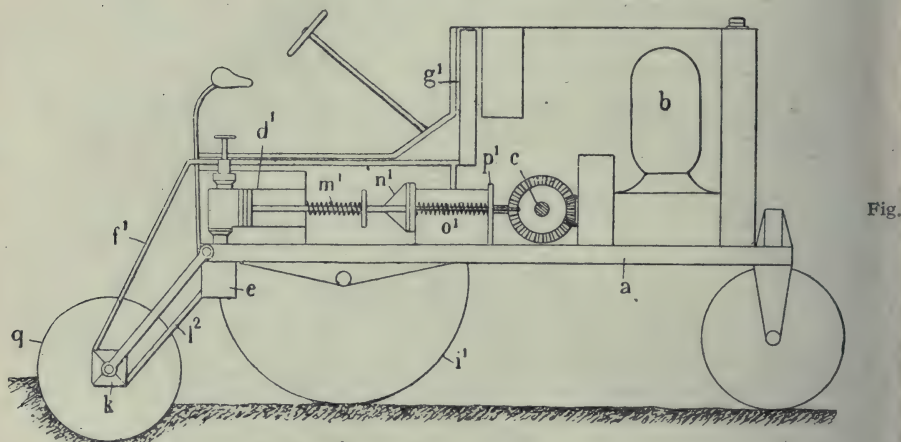


Fig.

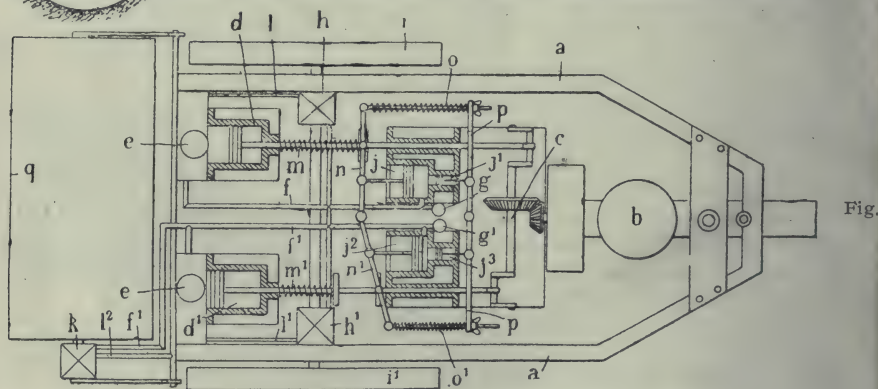


Fig.

Fig. 1: Vertical section.

Fig. 2: Plan.

ing for the normal work of the same machine. These groups are in relation one with the other according to the work the machine has to do; if, for example the resistance to the implements diminishes, then the machine moves quicker, and inversely.

The diagrams given above shows the arrangement used: on the chassis *a* an internal combustion engine *b* actuates a elbow-shaft *c* controll-

ing the two pumps  $d$  and  $d^1$  which draw water from a tank  $e$  to supply a pipe-system  $f$  and  $f^1$ . The pipe-system  $f$  supplies the air chamber  $g$  and the hydraulic motor  $h$  which controls the wheel  $i$  of the machine, and also the differential regulator pistons  $j^1$  and  $j^1$ . The pipes  $f^1$  also supply the air chamber  $g^1$  and the hydraulic motor  $h^1$  which controls the land wheel  $f^1$ , as well as the differential regulator pistons  $j_2$  and  $j_3$ . The motors  $h$  and  $h^1$  form part of the two "resistance" groups represented by the moving of the machine.

A third hydraulic motor  $k$  can be fed by one of the pumps  $d$  and  $d^1$  on opening the right tap. In this case, the other pump only works the two motors  $h$  and  $h^1$  serving to move the machine. The motor  $k$  controls the working parts (shares, harvester, transmission, etc). The regulating device controls the large pistons  $j$  and  $j^1$  connected with the levers  $n$  and  $n^1$  which are fastened by adjustable springs  $o$  and  $o^1$  to the axle on which the little differential pistons  $j_2$  and  $j_3$  are coupled.

When the working implement meets a sudden resistance, it causes increased pressure in the motor  $h$  controlling that implement and in the pipe system  $f$  in such a way that the corresponding piston  $j_2$  acts on the lever  $n^1$  to diminish the speed of the piston of the pump  $d^1$  while the corresponding differential piston  $j_3$  acts at the same time on the axle  $p$  to diminish the pressure in the other pipe-system  $f^1$  so that the power of the motors  $h$  and  $h^1$  serving to move the vehicle are decreased in power to that amount.

73 - **A Simple Apparatus for Clearing Vines.** — MOLINES U., in *Le Progrès agricole et viticole*, Year 33, No. 47, pp. 499-500. Montpellier, November 19, 1916.

The writer recommends, for pulling up vines, the following machine which he has used to clear a large area, and which can be quickly and cheaply made: A pair of wheels, even if not very strong, are joined by an axle which projects beyond the hubs. On each side, an iron bar is fixed by its middle to the projecting end of the axle. The anterior part of the bar supports a wooden axle-tree rigid like the shaft to be fastened to it and suitable for harnessing two animals, oxen or mules. To help traction, the free part of the bar may have a counterpoise. Round pieces of wood are placed between alternate spokes, which gives a sort of latticed windlass, turning with the wheels. Then a strong piece of wood should be fixed across and one end of a chain about 30 feet long should be attached, the other end being held by a man following the apparatus and who entangles with it the head of each stump. The stump comes away, followed by the roots.

Grafted vines in strong land may break at the point of union; this could probably be avoided by placing an iron plate on the side of the stalk opposite to the direction of pull.

The driver and animals soon become accustomed to stopping and starting, and after a while can easily clear half a hectare in a day.

74 - **Hay Sweep.** — *The Implement and Machinery Review*, Vol. 42, No. 499, pp. 756-757, 3 figs. London, November 1, 1916.

Figure I shows the CARNE Hay sweep ready for transit. The apparatus has the advantage of having the land wheels fixed so as to give a good

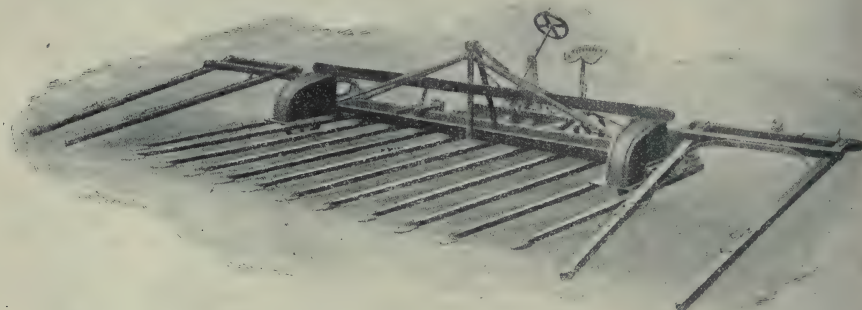


Fig. 1. — Carne's Hay sweep ready for work.



Fig. 2. — Carne's Hay sweep arranged for transit.

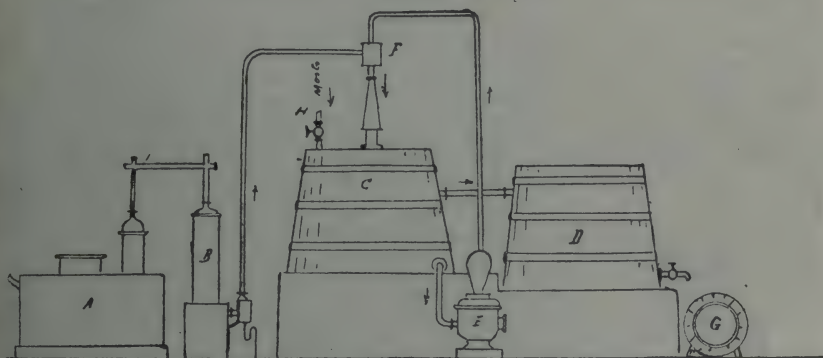


balance. They are housed on iron arms hinged on the end castings, so that the land wheels may be placed 14 in. in advance of the carrier bar, and inside the end tine. To prevent hay from clogging the wheels, they are guarded with sheet iron covers. The tines are operated by means of a worm and worm wheel, the shaft of which is placed near the drivers seat, and it is claimed that this gear will raise a 10 cwt. load and sustain it at any point. It is also adapted for carrying corn, since the tines are easily lifted clear of the ground. For transport, the CARNE hay sweep can be raised as shown in fig. 2.

75 - **Apparatus for Sulphuring Musts and Wines on a Large Scale by Sulphur Dioxide produced directly by Burning Sulphur.** — CIAPETTI G., in *Giornale Vinicolo Italiano*, Year 42, No. 45, pp. 784-786. Casale Monferrato, November 5, 1916.

An apparatus recently devised for sulphuring any quantity of must or wine by using sulphur dioxide produced directly by burning sulphur, instead of using liquid sulphur dioxide or metabisulphite.

The liquid to be sulphured (wine or must coming from the press, first filtered through a wire gauze with a 2 mm. mesh) is contained in a covered vat C, which is supplied as required by a pipe with the tap H and leading from a vat placed high up (not shown in the figure) which is filled by a pump.



Apparatus for sulphuring must and wine on a large scale.

The vat C is covered by a bronze mixer F communicating on one side with the furnace A where the sulphur is burnt, and on the other with a suction and force pump E which pumps the liquid from the vat C; this liquid passes through the mixer and returns to the vat C carrying with it the sulphur dioxide sucked from the furnace; this operation continues until the liquid is sufficiently saturated, which can easily be ascertained by an iodine test.

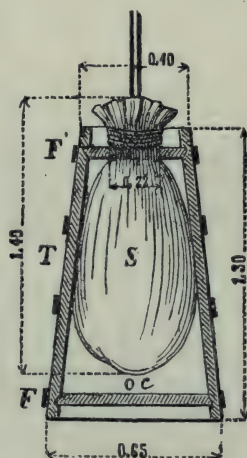
When the sulphuring is finished, the tap H is opened to fill the cask C, thus displacing the already saturated liquid which passes by an overflow into the vat D. From the latter, the sulphured wine or must is run off into barrels.

This apparatus gives regular and continuous sulphuration, and requires no attention other than feeding more sulphur into the furnace. It can be made in various sizes.

76 - **A Simple Apparatus for Filtering Wine-lees.** — *Giornale vinicolo italiano*, 42nd Year, N° 48, p. 845, 1 Fig. Casale Monferrato, November 26, 1916.

This very simple filter, designed by D<sup>r</sup> VANNUCCIO VANNUCCINI, is made up of : a barrel *T*, shaped like a truncated cone, 1.3 metres long with a diameter at the lower end *F* of 0.65 m. and at the upper end *F'* of 0.4 m. and a circular opening 0.22 m. in diameter in which can be placed a sown cloth sac 1.4 m. long and about 1.4 m. in circumference.

The empty sack is placed in the barrel : in its mouth which covers the circular opening of the barrel, the lees are poured till nearly full; the mouth



VANNUCCINI apparatus for filtering vine-lees.

of the sack is then tied with strong cord, sufficiently long to leave two free ends allowing of suspending the apparatus to the ceiling of the wine shed for some time.

The barrel, being heavy, tends to slip down over the sack ; the latter also tends to gradually emerge through the circular upper opening, where it is thus pressed and the liquid is forced through the cloth into the barrel, whose weight, thus increasing gradually, also increases the pressure on the sack and also on the lees, which becomes more consistent in losing liquid and also is more resistant to the passage of the filtered fluid.

When filtration is finished, the wine is withdrawn, by means of a bung hole placed in the lower part of the barrel.

77 - **A New Apparatus for the Distillation of Peat at a Low Temperature.** — *The Times Engineering Supplement*, 12th year, No. 505, p. 183, November 24, 1916.

Raw peat, when it is cut, contains up to 90 per cent of water. In the apparatus in question, after the formation of briquettes, the peat is first dried in a horizontal chamber through which passes a current of hot air and where the briquettes are continually in movement. During its passage through this chamber, which occupies 45-50 minutes, the water content of the peat is reduced to 20-25 per cent.

At the beginning of the operation, heat is supplied by means of producer-gas generated from an auxiliary apparatus working with air-dried peat, but after an hour or so, the gas evolved from the distillation of the peat is sufficient for all purposes.

As soon as the temperature of the retort approaches 100° C., the gas and steam are drawn off at the upper part of the tube, passing into a condenser of special construction which takes the form of a series of shallow, inverted cones. At the top of the condenser, the hot vapours encounter a current of cooled gas, which deprives them of all watery particles.

The coal-tar oils are also condensed separately, while the non-condensable gases are used for combustion. It is important to note that the condensable oils are drawn off by a special apparatus, as soon as they are found in the retort. For working and briquetting the peat, 1 H. P. per ton of peat is required.

The yield of oil, of course, varied with the nature of the peat, and amounts to from 25 to 30 gall. per ton of dry peat.

After the extraction of the oily matters and tar, the charcoal remaining in the retort is withdrawn by an automatic process; it ranges from 30 to 33 per cent of the weight of the raw peat. It contains on an average: 11.82 per cent of volatile matter, 79.71 per cent of fixed carbon, and 8.47 per cent of ash.

In working up the water solution from the process, the yields per ton of peat treated were as follows: methylated spirit 2.56 gall., acetic acid 19 lb., ammonium sulphate 8.0 lb.

The process is equally applicable to lignite, wood, and many kinds of shale.

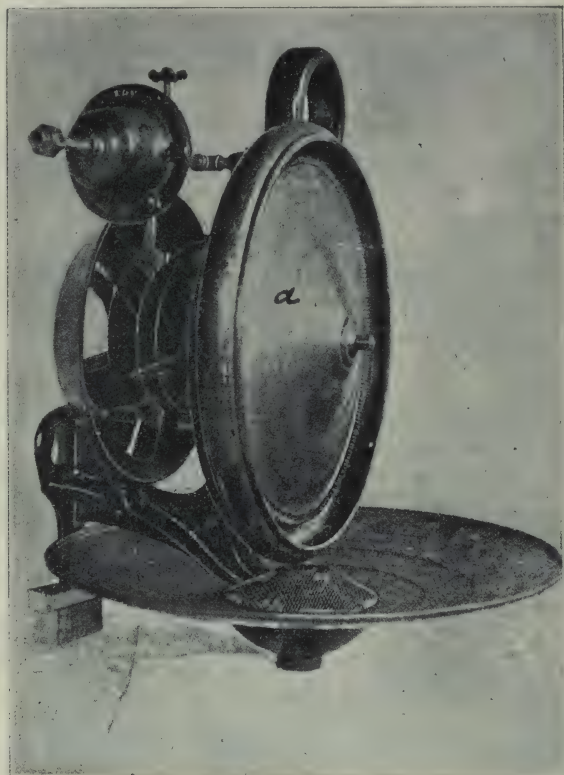
78 - **A Device for the Automatic Regulation of the Humidity of the Air.** — *Scientific American*, Year 72, No. 41, p. 355. New-York, October 14, 1916.

A device to regulate the moisture in the air of bakeries, feather factories and tobacco houses, cotton and various textile mills, where a constant humidity is required.

The device is electrically operated, automatically controlled and entirely self contained. It is mounted on the walls or columns of a room or suspended from the ceiling; besides, the control apparatus is provided with a deflector which is in the regulator chamber, and when atmospheric conditions require, the deflector turns a current of water which flows to the centre of a rapidly revolving disk *a*.



The water is thrown out by centrifugal force against the teeth of a copper grid at the circumference of the disk. Behind the disk is a fan



Device for the automatic regulation of the moisture in the air.

which forces out all particles that are sufficiently fine to float round the edge of the case.

#### 79 - Review of Patents.

##### *Tillage Machines and Implements.*

##### Canada

- 170 845 — 170 899 — 171 584. Ploughs.
- 170 848 — 170 875 Landrollers.
- 170 853. Knife combined with pulveriser for cutting weeds.
- 170 896. Lubricating for ploughs.
- 171 045. Agricultural Implement Drive Mechanism.
- 171 198. Plough share.
- 171 592. Agricultural Machine.
- 171 605. Weeder and Cultivator.

- Denmark 21 539. Double balance plough.  
21 582. Motor plough.  
21 583. Device for motor plough.
- France 480 370. Device applicable to a motor plough or other machine provided with several shares.  
480 425. Cultivators.
- Italy 154 649. Mechanism of motor plough.  
155 423. Reversible ploughs for animal or mechanical traction.
- \*United Kingdom 8 554 — 8 685. Ploughs.  
8 555. Motor plough.
- United States 1 194 166 — 1 194 668 — 1 200 106. Ploughs.  
1 196 222. Wheel plough.  
1 196 293. Gang plough.  
1 196 432 — 1 196 606. Pulverisers.  
1 196 549. Disk cultivator.  
1 197 009. Motor plough.  
1 197 415 — 1 198 846. Harrows.  
1 198 571. Adjustable orchard plough.  
1 198 942. Coulter.  
1 199 005. Power operated mechanism for tractor ploughs.  
1 199 329. Cultivator shovel.

*Manure distributors.*

- France 480 509. Process for improving the productivity of the soil by using iron titanate or ferro-titanic sand.  
480 569. New process for making compound manures.
- United States 1 194 358. Spraying apparatus.  
1 195 879. Fertiliser distributor.  
1 197 292. Combined seeder and guano distributor.  
1 198 900. Proportioning Drum for mixing fertiliser material.  
1 199 417. Manure spreader.

*Drills and Sowing Machinery.*

- Canada 170 862. Process for coating seed with fertiliser.
- United States 1 193 501. Planter.  
1 198 928. Potato planter.

*Control of Diseases and Pests of Plants.*

- United States 1 194 358. Sprayer.

*Reapers, Mowers and Harvesting Machines.*

- Canada 170 950 — 170 952. Binders.  
170 951 — 171 183. Shocker.  
171 673. Grain Binder mechanism.
- Italy 154 597. Improvements in mowers.
- United Kingdom 9 978. Harvesting machine.

*Machines for Lifting Root Crops.*

- France 480 359. Potato lifting machine.
- United Kingdom 10 379. Harvester for potatoes and the like.
- United States 1 193 746. Peanut Harvester.  
1 194 359. Machine for topping beets.  
1 195 563. Machine for harvesting Potatoes.  
1 198 985. Beet harvester.

*Threshing and Winnowing Machines*

- United Kingdom 8 416. Threshing Machine.  
 10 258. Seed separator.  
 United States 1 200 253. Threshing machine feeder.

*Machines and Implements for the preparation and storage of grain, fodder, etc.*

- Italy 153 622. Low and high temperature drier for cereals, cocoons, etc.  
 154 708. Drier with horizontal superimposed shelves and movable rakes,  
 for maize, etc.  
 154 784. Improvements in straw elevators and the like.  
 United States 1 195 479. Feed for baling machines.  
 1 196 126. Baling press.  
 1 196 247. Hay loader.  
 1 199 579. Hay cocker.  
 1 200 280. Mounting for silo floor.  
 1 200 330. Silo roof.

*Steering, etc. of agricultural machinery.*

- United States 1 195 341. Steering means for tractors.  
 1 195 373. Automatic adjusting mechanism for tractor guides.  
 1 194 269 — 1 194 738 — 1 196 507 — 1 198 445 — 1 198 494 — 1 198 849 —  
 1 201 432. Tractors.  
 1 198 444. Mower tractor.

*Feeding.*

- Canada 170 716. Calf weaner.  
 United Kingdom 8 251. Shredder for vegetables.  
 10 264. Food for animals.

*Apiculture.*

- Canada 171 530. Bee smoking device.

*Aviculture.*

- Canada 171 259. Egg preserving method.  
 United Kingdom 9 892. Hatching appliances.

*Fish-breeding.*

- United Kingdom 10 817. Fishing nets.  
 10 827. Fish traps.

*Industries depending on plant products.*

- Canada 171 393. Peanut butter grinder.  
 171 630. Rubber preserving compound made of cocoa butter, castor oil  
 and gasoline.  
 Italy 150 576. Apparatus for the rapid acetification of wine, cider, beer and  
 alcohol.  
 152 679. Apparatus for dehydrating fruits and pulses.  
 153 598. Machine for the simultaneous extraction of the essence and  
 juice from citrons, bergamot oranges, oranges and manda-  
 rins.  
 154 376. New GIACCHETTI process for preserving bread made from wheat  
 and other cereals for human consumption.



- Netherlands 1 451. Method and device for collecting the juice from sugar cane and other sacchariferous plants.
- United Kingdom 10 382. Fumigation chamber for coagulating latex, and containing a series of inclined planes.

*Dairying Machines and Implements.*

- Canada 170 878. Milking machine.  
171 108. Pasteurizer.
- Denmark 21 507. Combined Pasteurizer and Regenerator.
- France 480 450. Milking Machine.
- United Kingdom 9 776. Cream separator and churner.  
11 192. Milking Machine.

*Various.*

- Denmark 21 571. Peat press.
- United Kingdom 8 415. Refrigerator.  
10 253. Bottle washing machine.

80 - **The Ventilation of Farm Buildings.** — I. GRISDALE (Director, Dominion Experimental Farms) and ARCHIBALD E. S., in *Dominion of Canada, Department of Agriculture, Dominion Experimental Farms Bulletin* No. 78, pp. 32, fig. Ottawa, May 1914. — II. *The Agricultural Gazette of Canada*, Vol. 3, pp. 598-600, fig. Ottawa, July 1916. — III. TRUEMAN J. M., the King System of Ventilation, *Ibid.*, pp. 615-618, fig.

After some general considerations, the different causes of failure in the installations are defined, such as the choice of an unsuitable system, want of space, attention, etc. An important point is to prevent water condensing on the interior walls of the buildings by covering them with wooden linings.

*Cubic feet of air per cow.* — The number of cattle must be considered: too many cattle makes it difficult to ventilate without draughts, while too few makes it difficult to avoid a low temperature and at the same time to ventilate well. 600 to 800 cubic feet of air space should be allowed for each cow two years old and over.

The ventilation of shippens, stables, and piggeries is discussed and the results of experience and observation are given.

A. VENTILATION OF SHIPPENS.

**RUTHERFORD system.** — This system has been shown to be the most simple to work, and is easy to install in old or new buildings, while it is adaptable to all classes of stables, suitable for different climates, and effective in controlling the temperature in all parts of the stable.

*Installation of the Rutherford system in a stable for 24 cattle :*

*Fresh air inlet :* at soil level, on the left hand side by direct passage, on the right by a U shaped passage, covered externally by a small roof.

*Foul air outlet :* by one or two shafts projecting above the roof covered with a cowl, and regulated by a valve. In another type, the outlet shaft emerges at the side of the building, above the middle of each row of animals for a better effect.

The U shaped inlets are very useful; the outer arm should be made longer than the interior arm in countries with much snow.

MR TRUEMAN observes that the cold air entering on the soil level chills it and also the lower layers of air in the shippin, which is a disadvantage in cold winters. Further, he says that the RUTHERFORD system provides the purest air for the animals in medium size buildings, but that the cold air chills the animals when the outlet shafts are closed and ventilation ceases.

The KING System which has many admirers and with which many have succeeded, is remarkable for the fact that the foul air is drawn from the floor and the fresh air enters at the ceiling. The advocates of this system

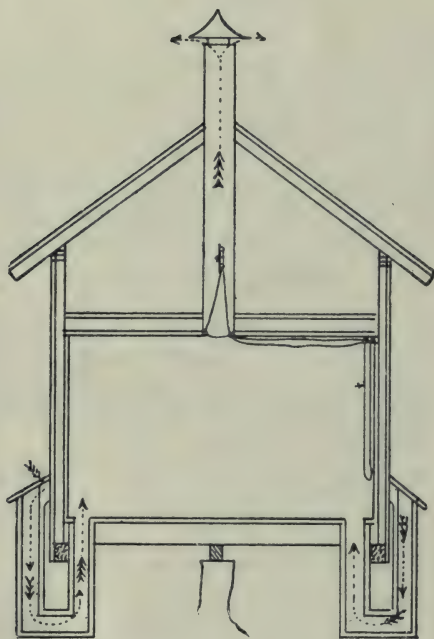


Fig. 1. — RUTHERFORD Ventilation System.

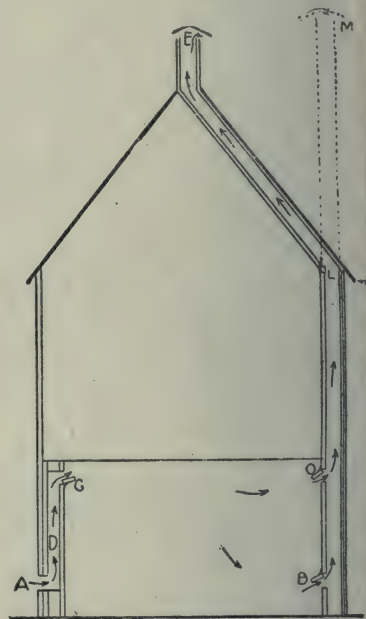


Fig. 2. — KING Ventilation System.

claim that since the chief impurity is carbonic acid gas which is heavier than pure air, the outlets for impure air should begin near the floor-level. On the other hand, it cannot be easily applied to all shippins, and it requires a large number of ventilating shafts. Again, the insulation of the walls has to be done very carefully, for the impure air descending to the soil may condense moisture on them.

MR TRUEMAN quotes, in favour of the KING system, the fact that it provides plenty of pure air in medium sized buildings. The air warmed by

the animals rises up and mixing with the fresh air, raises its temperature to a suitable degree without vitiating it.

The vertical section shown in fig. 2 shows the path of a current of air going from A to C and which reaches the roof, then the opposite wall, and escapes by two openings in the outlet shaft, one below, the other above.

In the pierced walls system, there are ventilating holes near the ceiling in the walls exposed to the air. The openings should be 4 ins. in diameter at 3-foot intervals which gives 30 to 36 openings in a standard shippon. There is no regulating system.

The *Convection* system depends upon convection due to the heat from the animals causing displacement of the lower air which, when warmed, will

#### KING System : Types of outlet shaft.

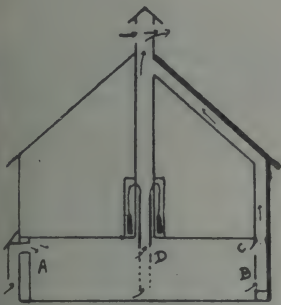


Fig. 3. — Central shaft, and lateral shaft following the roof.

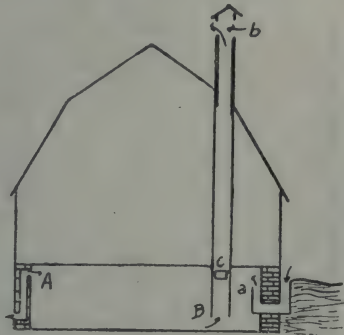


Fig. 4. — Eccentric outlet shaft.

ascend and be replaced by cool air entering by two windows in the opposite walls. If only a single shaft is used, it should be 2 feet square.

If two are used, each should be about 1.5 feet square, one in the centre of the building and the other to one side but joined to the first by a shaft running parallel to the roof. The shafts should be 2 or 3 feet higher than the roof and provided with a cowl and a regulating valve. At the barn floor the central shaft has a door to allow of hay or straw being thrown down in the shippon.

In the system "E" which is a modification of the KING system, the ventilating shafts are placed entirely inside the building. For 20 cattle there should be 6 shafts, each 12 inches by 6 inches in section, and 3 shafts on each side. Trap doors can be added for regulating the air. It works well and costs \$ 12 for a shippon of 22 cattle.

#### B. VENTILATION OF STABLES.

In 1906 on the Central Experimental Farm, a stable for 23 horses was built. The ventilating system was a combination of the KING and RUTHERFORD systems. The air enters by the left side close to the soil, passes by



an underground pipe opening in the centre of the stable, while on the right side, the air enters low down, passes towards the ceiling, then goes out low down at the left side, and by a central shaft. These two systems, though installed in the same stable, can work independently of one another.

The RUTHERFORD system gave the best results by removing the humid and vitiated air from the stable.

### C — VENTILATION OF PIGGERIES

This question presents no difficulty save for young fall pigs which require an ample supply of fresh air without lowering the temperature induly.

*Ventilating shaft with double isolating walls for the exit of impure air.*

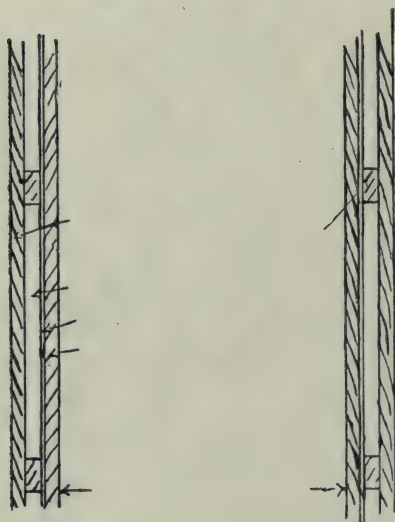


Fig. 5. — Vertical Section.

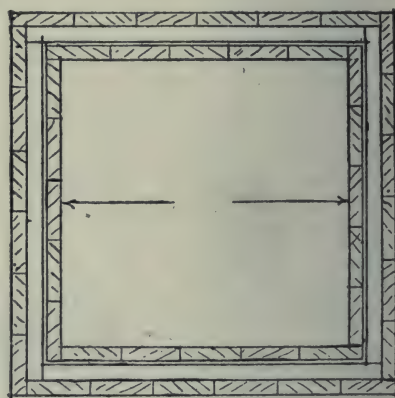


Fig. 6. — Horizontal Section.

To gain some information on this subject, 2 single pen piggeries were built on the experimental farm and ventilated with modified and ordinary KING and RUTHERFORD systems :

#### EXPERIMENT I.

*Pen No 1* : KING system combined with central shaft and regulating valve (RUTHERFORD).

*Pen No 2* : Air enters on RUTHERFORD system ; exit at opposite side ; regulating valve ; no central chimney ; shaft opening on the roof.

#### EXPERIMENT II.

*Pen No 1* : Air enters on RUTHERFORD system ; exit by central shaft with valve.

*Pen No 2* : Air enters on RUTHERFORD system : exit on opposite side

## EXPERIMENT III.

*Pen No 1* : Air enters low down on lift side ; exit on same side and by central shaft ; no valve.

*Pen No 2* : Air enters high up below ceiling ; exit on opposite side and by the shaft opening on roof.

## EXPERIMENT IV.

*Pen No 1* : Air enters low down on left side ; exit on same side below ceiling ; central shaft without valve ; escape by opposite side and from the shaft following the slope of the roof.

*Pen No 2* : Air enters on RUTHERFORD system ; exit on opposite side high up.

**RESULTS.** The RUTHERFORD system has been adopted for a large model piggery. In the provinces of Quebec and Saskatchewan, this system has been adopted as it gave the most conclusive results.

81 - **Arrangement for Securing the Safety of Horses in Case of Fire.** — *Scientific American*, Vol. CXV, No. 15, pp. 326 and 338, 2 fig. New-York, October 7, 1916.

A device used in a stable in Los Angeles (U. S. A.), composed of ordinary stalls, provided with mangers and racks ; the end of the stall by the horses head is closed by a door so mounted that it opens by its own weight as soon as the holding bolts are withdrawn. The bolts are controlled by a wire running along the wall of the stable and which has easily fusible plugs placed at equal distances apart. If fire occurs anywhere, the plugs melt, open the bolts and the door of each stall automatically opens. At the same time, a door closes at the entrance to the stall, preventing the animal from going into the stable. In addition, the mangers fall automatically, thus freeing the halter ; the noise caused by the opening and closing of the doors and the fall of the mangers, is sufficient to frighten the horses which, as has been shown by experiment, quickly escape by the outlet that opens in front of them.

82 - **A Portable Sheep Shelter on a Farm in Central New-York.** — *The American Agriculturist*, Vol 98, No. 16, p. 8. New-York, October 14, 1916.

This comparatively cheap apparatus protects the sheep from the hot sun in summer and serves as a shelter for the sheep to huddle together on cold nights in spring and autumn. It consists of a 4 sided roof mounted on 4 broad-tyred wheels, which enable it to be easily moved about.

## RURAL ECONOMICS.

83 - **The Method of Valuation of Real Estate.** — SERPIERI ARRIGO, in *Annali del R. Istituto Superiore Forestale Nazionale*, Florence, Vol. 1, pp. 83-131. Florence, 1916.

Certain questions of forest valuation, which recently caused much discussions (choice of rate of capitalisation, choice of rotation, etc) on rural valuation, following on the publication of a German treatise by FRIE-

DRICH AEREBOE (1), which differences could probably have been adjusted by the general principles of economic science. The work is divided in 2 parts, the first of which methodically considers the general principles of valuation that are applicable to any economic question and bearing on the most controversial points in rural and forest valuations. Limitations of space in the first volume of the Review in which the article is included have only allowed the publication of the first part of the work, under the title: *Contribution to a general theory of valuation and the methods of valuation*. Thus, the first part only is dealt with, and the summary of the principles of the question is given below.

All real estate, a) material objects, b) services, c) property rights according to FISHER'S (2) subdivision (adopted by the writer), may be valued. An expert may value land (class a) or may estimate the rent due from such land (class b) or, again, a right held over the land as in a long lease), and which constitutes the right to obtain a part of the *services* and revenues yielded by the land (class c).

Belonging to the first class (material estate) may be distinguished: *consumable property, auxiliary or productive property*, and also *temporary and durable property*. For valuation, the distinction between temporary and durable property is important, for while the value and service of the former cannot be estimated, the latter can well be valued.

The valuation of an economic property means the determination of the amount of money than can be considered as equivalent to the property. This value not only can, but *must*, vary according to the aim of the valuation, and the aim gives the key for the correct solution of any problem of valuation. The aims of a valuation can be, even if not explicitly stated, understood in only one way by the interested parties; if this is not so, the aim must be clearly defined.

Many controversies on the method of valuation have been caused by the aim being insufficiently precise, but often the expert has not to define it, as it is a juridical or economic problem. Such is, for example, the valuation of improvements to land, when the aim is to fix the compensation due to the tenant who has carried out the improvements. The amount of compensation or the criterion for the valuation may be defined in the contract, and then the expert has only to apply them as defined in such contract. If not mentioned, they would be applied according to the custom of the country, and then the expert should keep to the usual method.

If no customs or laws exist as necessary premises for the work of the expert, their existence should be assumed. In such a case the necessary criteria for such an assumption can only come from economics and law, not from estimation.

The various criteria chosen according to the aim of the valuation may lead to estimation either on the basis of *the buying or selling price; the mar-*

(1) See AEREBOE Dr FRIEDRICH: *Die Taxation von Landgütern und Grundstücken*, 1 vol., 542 pp, 52 plates. Parey, Berlin, 1912.

(2) See IRVING FISHER: *The Nature of Capital and Income*. London, Macmillan, 1906.



*ket price* ; the *cost price* ; or on the basis of the *capitalisation of the revenues*. In certain fairly common cases the criterion may be of *substitutions*, or again the *price of transformation*, as, for example, when it is to be decided whether it is more profitable to sell forage directly or rather indirectly as meat, milk, etc.

Valuation on the basis of the buying and selling price is the most common, and in speaking broadly of the *estimated value*, the probable market price is most often meant. With a certain period and market, the prices are fixed according to the supply and demand. This fact must be appreciated by the valuer, though this criterion is not applicable to every valuation. If the unsaleable deadstock of a farm is to be valued, this criterion is of no value, as no market exists (1).

If the injury due to destroying a coppice has to be estimated the criterion to be used in such a case is the capitalisation of the revenue lost. If, on the other hand, the sale price of the mass of wood has to be fixed, then the market price must be considered and the result may be quite different. It is not a case of two values, but of two different criteria decided by the aim of the valuation. In the valuation of agricultural real estate, the presumable buying or selling price is not always required. In dividing successions, for example, the dominating factor is the equality of the incomes, and certain recent laws, as in Switzerland, even enforce it. Thus the value to be given to the real-estate forming part of the patrimony to be divided is that obtained on capitalising the revenues and not the market value in case the two do not agree. In estimating on the basis of the sale or buying price, the two must be separated when the estate to be valued is remote from the market as expensive carriage may completely alter the case.

Valuation on the basis of cost price requires some explanation as to the meaning of *cost*. In practice, *cost* means the total expense necessary to obtain some given economic estate. But as the condition of the person bearing the cost may vary, as well as the means used to obtain the estate in question, several kinds of *cost* must be distinguished. In general, when speaking of *cost*, one refers to the *producer* and indicates the total cost of production. In this way, the calculation of the cost of production refers to the manager considered as distinct from the capitalist and worker (manual or intellectual). The manager is considered as buying on the market all necessary means of production, whether material things or services. Capital is included among the services and its price is interest ; and the men's work, whose price includes salaries, etc ; also services rendered by public institutions the price of which is fixed by the laws of production. These are the buying prices, which, in their totality or by the share required for paying off, constitute the *cost of production*.

This concept of the cost may also apply to a manager having certain of the elements necessary for production. The cost of these elements is

(1) See SERPIERI A : *Intorno ad alcune più controverse valutazioni agrarie*. Conegliano, Arti Grafiche, 1906.

thus represented not by the buying price, but by the income given up by the contractor and which he could have obtained. Again, the cost varies as the position of the contractor, and that varies with time, as the prices are variable.

A farm producing various substances can not have a cost for each product, but a *general* cost of the collected products. The cost of a product, as understood in ordinary language, is in reality only the proportional cost of a part of the whole. A simple method of fixing the proportion is to subtract the sale price of all the products less one from the cost of the whole and to consider the remainder as the cost of the one product. The producer who wishes to find the cost of his products separately, in order to have some rule for fixing the individual sale price, finds it convenient to apply to each article its *specific* expenses and to divide the other *general* expenses in varying proportions according to the nature of the article. Other methods might be used, according to the object, but it is necessary to include the *analytical accounts of cultivation* and the *proportional division of the general cost with the price of products on the market*.

In many cases of valuation on the basis of the market price, the calculation of the *supplementary cost* is required, which differs from the preceding and is present each time that the successive unit cost of the product obtained by a contractor is unequal to the previous ones, but increases or decreases in relation to them.

In this case the method of division is no longer *static* but *dynamic* as regards the *variation of the cost* in changing position. This conception of the supplementary cost can be equally applied, in considering a number of products, to a new product, different from previous ones, and which thus increases the cost and may be different from that borne on this head by anyone producing the same thing under other conditions. It can also be applied to new products replacing previous ones, such as a crop replacing another in a rotation, so as to include, in the increased cost price, the loss of sale price, that would have been realised by the product now replaced by another.

After considering this concept of cost, the Author shows that, in many valuations, their aim necessitates close reference to the criterion of *cost* and to one or other of its practical applications. Controversies bearing on inventory valuations only exist when the aim of the inventory is not clear, as it can be varied and at the same time legitimate. Valuation based on capitalisation of the revenues is considered by many as the only rational method of valuation, which is obviously erroneous, for, above all, it is not applicable to all economic estate, but only to economically *durable* estates, which yield services having a clear and distinct price, or to *property rights*; in the second case, because in many cases the aim of valuation requires different criteria and consequently different methods.

Nevertheless, the criterion of capitalising revenues is one of the most important and also the one most often used. It is applied by summing all the revenues accruing from the estate under consideration, after having discounted them at the time of valuation at a rate fixed by the rules of com-



pound interest as shown by financial calculations. Therefore this method of valuation implies a forecast of the revenues that will be yielded by the estate in question, that is to say that it implies the anticipation of the importance of its useful prestation, the advantages it will produce, and their valuation ; in addition, the choice of the rate of discount (or of capitalisation).

The exact interpretation of the result of the valuation is not possible if the criterion used for the valuation of the revenues and the choice of the rate is not known. But, if known, it is a fundamental point for reference and an excellent guide for suitably placing an investment, as well as for buying or selling some durable economic estate. If the estimation of the revenue is required, the choice of the rate of capitalisation is practically indifferent. Whatever rate may be adopted, the interpretation expressed more highly is always correct. The rate may be given to the estimator when asking the price to pay for a certain estate and when a *fixed revenue* is desired from the investment. But the valuer may also choose the rate as well as forecast the revenues, as when it is required to know the relative advantage of investing in a given estate in comparison with other estates showing possibilities for investment. In this case, the terms of comparison must be chosen or one or several possible investments at that time and that market, and of which the annual unit income is known. But the expert can provide other important elements of judgment besides forecasting the revenues, and he can consider them together when proposing the rate of capitalisation. The elements refer particularly to the *risk* and constitute the *coefficient of probability* relating to anticipated revenues. The criterion of estimation for capitalising the revenues may have many applications on this head, but the value of capitalisation obtained should always be interpreted and employed within the limits of the indicated aims. It is obviously wrong to confuse the value of capitalisation which solely relates to certain clear aims of the estimation, with the market price, or again, to consider the latter as *exact*, *real*, etc. the former, on the contrary, as unjust and arbitrary.

Having established that the choice of the method of estimation should most certainly be considered with the criterion of valuation, to be applied, in agreement with the aim of the valuation, to some of the criteria of valuation, like those of cost and capitalisation of the revenues, there can be no doubt as to the choice of the method, which is plainly manifest in the determination of the criterion of valuation. On the other hand, if this cannot be assumed, the criterion of the market price is applied to the estimation. Here, there are several possible methods, which must be realised in order to choose the most suitable, for in applying each of these methods, certain conditions must be fulfilled to obtain good results.

The writer carefully examines these methods and deduces the relations between the market price and the values found by applying other criteria of valuation. He divides the various *methods* of finding the market price of any estate in the following manner:



- A — Synthetic estimation (direct).
- B — Analytic estimation (by capitalisation).
- 1) By capitalising at the average rate of the investment under consideration.
  - a) with synthetic estimation of the revenues.
- 2) By capitalising at the rate of other investments considered as analogous.
  - a) with synthetic estimation of the revenues.
  - b) with analytic estimation of the revenues.

All these methods cannot be applied to all economic estates. Only the estates of durable utility and which give *productive services* allow them all (as, for instance, land), but according to circumstances and not all with equal facility.

If it is required to fix the market price of present material property (food, fuel, seed, etc). the *synthetic method* is the only one that is applicable; but, to apply it, the property must be able to be compared with a type, so that the prices quoted in a number of exchanges may be known, having all been at a sufficiently close time to that of estimation to prevent the conditions of demand and supply from changing too much; and over a sufficiently limited area to allow of agreement, even if approximate, to the abstract conception of the economic market. For immediately utilisable material property, the previously discussed conditions often recur sufficiently, and, in consequence, the method allows of sufficiently accurate estimations: it is therefore, in these limits, a rational application.

The same may be said of the services yielded by consumable property, or useful prestations withdrawn from the consumable estate and of which they form the revenue. There appears to be no other method applicable to them save the *synthetic method* which allows more or less accurate estimations according as the conditions (considered above) are present in a greater or less degree. Such would be, for example, the estimation of a rent to be yielded by a dwelling-house.

This *exclusive* applicability of synthetic estimation to finding the market price of *immediately utilisable materials* and the *services from consumable property* is attenuated, according to the author, in considering the help rendered by the knowledge of the cost of production. To this end, the writer examines the relationship between the *cost of production* and the *equilibrium price*, and finds that, in order to follow up the estimation with the hope of obtaining results not too far from the truth, certain conditions should be present that do not equally belong to every case, and which also should be considered each separately. The *process of ordinary production* followed by most manufactures of the materials to be valued, at that time and on the market determined, and which is the basis for the calculation, should be determinable in an objective way without allowing too much freedom to the estimator;

It must be possible to fix a price for the contractor for all the material and service required for production, including the payment for the *usual activity* of the management, which is expressed in the ordinary process mentioned above.

In approximating the calculation of the cost of production with more

or less productive technical methods than the usual ones, in including in the expenses the payment for the usual acumen of the management there would be a positive or negative difference representing the positive or negative retribution of the particular aptitude above or below the normal and possessed by the organiser or director of the business or estate. In this sense, more or less costly methods might be suggested; producers being dear or cheap as long as the payment for an ordinary ability is included in the cost; and, in practice, it would be impossible to do otherwise, for there is not a sufficiently extensive market for *able direction* which can allow the recognition of the different values of varied ability of management, that is to say of the various technical methods applied. In the abstract sense in including the price of this clever management in the calculation according to the measure desired, the same cost would always be obtained, no matter what technical method was to be considered for application.

The verification of the market price of some estate based on the determination of the costs of production is a rarely used method, for all the required conditions are not always present. When they are present, it is often for goods to which other methods of estimation, especially the *synthetic method*, are more accurately and rapidly applied. This method is more suitable for auxiliary use as a control of other methods.

The synthetic method of estimation is not applicable when it is the case of partial ownership, which may be bought or sold and can have a price, as in the case of direct control of land held on a long lease. The intangibility of the object to be estimated excludes it. Buying and selling such a right means nothing more than buying and selling series of services, prestations of revenues, and by it is meant the algebraic sum of positive and negative revenues. The only possible way of estimation is to deduce the price of the right to be valued from the price of the services rendered by the right. This is the substance of the *analytical method* as opposed to the *synthetic method*. It must be ascertained if estimation on the basis of the capitalisation of the revenues can also help to find the market price. According to the Author, the question, is really the choice of the rate of capitalisation.

The necessity is shown of clearly distinguishing the interest ( $f$ ) of the capital (by capital is meant some economic estate producing revenues successively during time) from the rate ( $r$ ) of interest or the cost of using the saving, for keeping these concepts of ( $f$ ) and ( $r$ ) distinct serves to explain many practical questions of estimation which are most controversial. There can be two ways of capitalisation, one based on the rate of interest on the capital in question ( $f$ ) and one based on the rate relative to *other forms of investment such that the rate may be considered as equal to that required*. In the first case the prices actually realised and the corresponding revenues on a sufficient number of exchanges at the same time and relating to similar examples of the estate in question. Comparison between the price of the capital and the income gives the idea of the *mean rate of interest* of the investment considered at that time on the market. In the second case, to be able to consider the above mentioned equality as existing, the condition must be ful-



filled of knowing that the two investments under discussion (the one being valued and that used for comparison) are in mutual agreement and equal regarding all circumstances of safety, duration, etc., that are taken into account. Often recourse is had to the knowledge of the relative rate of the best investment negotiable at the exchange, but before using this rate for capitalising other investments, it must be remembered that it is only legitimate when the latter and the investment agree as to equal safety, duration, etc. Here lies the difficulty of this delicate method of investigation.

*Synthetic* estimation can be applied to *productive services* as well as to services rendered by consumable property; thus the rent (price for using the land) due for some stated real-estate may be estimated synthetically. But productive services differ from consumable property because, on account of their use in production, another method is applicable to them.

On account of their use in production, given that, for economic property, in producing which competition is active, the average price of a product  $P$  (round which the real prices oscillate) is equal to its cost of production  $K$ , the price of a given service  $K_1$  which forms part of the cost of production, may be estimated; for, if  $P = K$ , then  $K_1 = P - K_2$ , or  $K_2 = K - K_1$ . This method of estimation would be applicable with good results when the desired conditions are present, and the manner of relationship to the knowledge of the price of an estate on the market will be noted, taking as bases the determination of the cost of production, and the result of the estimation will be more approximately accurate as the value of  $K_1$  is greater compared with that of  $K$ .

The method of estimation suitable for *material estate of durable utility* is in the first place the synthetic method under conditions and following the modalities relating to material estate of immediate utility, over and above the application and the possible help of the determination of the cost of production in estimating them. But there is a difference between material estates of immediate utility and estates of durable utility, which is that the latter may conform to the method of analytic investigation, for useful prestations obtained from these estates are themselves the object of exchange on the market, and thus have a price. The price of material estate is the cost of the right to obtain these prestations and revenues. The question is, therefore, that of *capitalising the revenues*. This capitalisation can be made, either by means of the mean rate of interest on the capital under consideration, or by the rate of other investments considered to be similar according to the conditions previously mentioned.

The price of useful prestations or services that can be yielded by this estate can be fixed, either by the synthetic method, or also, if they are *productive services*, by the analytic method, by means of the analysis of the results produced according to the formula  $K_1 = P - K_2$ .

The method A, described above as *synthetic*, is also described as the *direct* or *empirical* method, while the method B, described above as analytic, is named *rational* by other writers.

The distinctions  $a - b$  and  $\alpha - \beta$  do not give occasion for the use of different names by other writers on the subject. The distinction  $\alpha - \beta$  is gene-



rally unnoticed ; the distinction *a - b* finds its counterpart in the distinction made by other writers on Rural Valuation between analytical (or rational) estimation based on the lease (and on the profit sharing system), or based on the administration of the owner.

Other methods of estimation are given by various authors. One, very commonly mentioned, is the *comparative* or *indirect*, or *relative* method of estimation, which is characterised by being founded on a comparison of the estate to be valued with other similar estates. But the writer does not think that this method can be considered as different, as the *synthetic* method is always necessarily founded on a comparison. When an expert expresses the capital value of an estate synthetically even if more or less knowingly, he makes nothing but a comparison between the estate to be valued and other similar estates, whose *qualities* and prices are known to him. The method called *comparative* or *indirect* consists in the comparison referring explicitly to a given type-estate.

## 84 - The Method of Determining the Cost of Production of Agricultural Products. —

MARENGHI E., in *L'Italia agricola*, Year 53, No. 8, pp. 337-338. Piacenza, 1916.

1) If on every farm it was only attempted to obtain a single product: wheat, or milk, or beef, etc., it would be quite easy to find the cost of production. In fact, it would be sufficient to divide the total average annual expenses by the quantity of the product obtained. But, with rare exceptions, the agricultural holding gives very diverse products at the same time. In this case, if a single unity of culture is observed, the total cost of production may be brought forward, but not that of each of the products.

2) To solve this problem, recourse is often had to a system of analytical accounts, but the method is too crude and inaccurate to give trustworthy results.

3) The writer is of opinion that the problem may be solved by keeping statistics for a number of similar farms from the standpoint of economic organisation. The information required for this purpose is:

a) the quality and quantity of each product obtained on the farm.

b) The average annual total cost of production. In expressing by :  $q_a, q_b, \dots$  the quantities of the products,  $a, b, \dots$  obtained on the average in each year in any one of the farms under observation ; by  $x_a, x_b, \dots$  the cost (unknown) of production relating to it ; by  $S$  the total expenses, the receipts and expenses should be equal, it would give :

$$q_a x_a + q_b x_b + \dots = S.$$

but if there are  $n$  farms being observed, where  $n$  is greater than the number of unknown ones, there would be a series of equations :

$$\begin{aligned} q_{1a} x_a + q_{1b} x_b + \dots &= S_1 \\ q_{2a} x_a + q_{2b} x_b + \dots &= S_2 \\ q_{na} x_a + q_{nb} x_b + \dots &= S_n. \end{aligned}$$

From this system it is easy to obtain, by using the method of least squares, the average or most probable values of  $x_a, x_b \dots$  which should satisfactorily solve the problem.

This method eliminates all the difficulties met with in establishing the crop accounts, for no arbitrary discrimination of the titles of expenses is required. These, as a whole, include : *Real or presumed leasing price of the real estate — interest on deadstock or livestock — reintegration of the capital — amount of raw material bought outside the farm — expenses for staff (labour, direction, administration, etc.) — taxes.*

The valuation of the labour is somewhat difficult on small farms worked directly by the farmer. But if the cost of production of any particular commodity is required, groups of farms must be chosen that produce mostly for the market and which for that reason are worked in another way.

If the cost of production of wheat is wanted, a number of varying farms should be chosen from varying districts. If, on the other hand, the work includes hills and mountains where the farms have a clear domestic value, then if the owner's work be valued at a normal price, the cost of production will be found to be much higher.

But for the agriculturist who consumes most of his products on his own farm, the idea of the cost is of much less practical importance, because he does not know it or only vaguely. This contradicts the economic law that affirms that, under free competition, the price of the goods is close to the maximum cost. As this is not so, it does not correspond to the truth, just as for similar causes, the laws of rational mechanics do not correspond to the real laws of the physical world.

The writer is collecting information to determine, among other things, the cost of production of grapes in the region of Piacenza, and proposes to return to this subject, dealing with it comparatively and in detail, if these researches lead to sufficiently accurate results.

## AGRICULTURAL INDUSTRIES.

INDUSTRIES  
DEPENDING  
ON PLANT  
PRODUCTS

85 — **A Contribution to the Study of the Yeasts of Wine.** — KAISER E., in *Revue de viticulture*, Year 23, Vol. XLV, No. 1158, pp. 149-155 ; No. 1159, pp. 165-170. Paris, September 1916

The use of sterile media inoculated with chosen yeasts has shown that certain races are very sensitive to the food-composition of the medium, to its richness in sugar, acids, or nitrogenous matter. The present work was undertaken to find how the nature of the nitrogen affects the fermentation of ethers. The nitrogen was given as ammonium sulphate, asparagine and monobasic phosphate of ammonia. In the last salt both phosphorus and nitrogen are obviously effective, and powerfully stimulate the action of the yeasts as well as zymatic fermentation.

The must used was composed of  $\frac{2}{3}$  Touraine must and  $\frac{1}{2}$  Burgundy must ; so as to show better the effect of adding nitrogen as compared with the flasks having received none, the must was diluted at the rate of 12.87

litres of must per 6 litres of water. The composition of the must was as follows.

*Composition of must per litre.*

Total acidity of control sample (as tartaric acid) . . .	4.92	grm
" " " phosphated control (as tartaric acid) .	10.96	"
Volatile Acid (as acetic acid) . . . . .	0.112	"
Sugar . . . . .	129.600	"
Total Nitrogen . . . . .	0.213	"
Ammonia. . . . .	0.0626	"

In series A the must alone (control) was used, or the previously mentioned nitrogen compounds were added at the rate of 1 % reckoned as nitrogen. The must was inoculated with the following yeasts obtained from the National Agronomic Institute Fermentation Laboratory: yeast 7 (Saint-Emilion), 32 (Langlade, Gard), 88 (Chambertin), 94 (Musigny) and 255 (pointed Burgundy yeast). The following relations were calculated: R. (fixed acids : fixed ethers), the two terms being expressed in tartaric acid; R'. (volatile acids : volatile ethers), the two terms being expressed in neutral ethyl tartrate. The results of the experiments are given in tables II and III; the fermentation temperature being 26° C., at which temperature the flasks were kept for 20 days, though the fermentation was usually finished in 10 days, and then they were left for 12 to 15 days at air temperature before being analysed.

TABLE I. — *Composition of the wine obtained with yeast 32.*

	Control	Sulphate	Phosphate	Asparagine
Alcohol . . . . .	5°7	5°7	5°4	504
Total Acidity. . . . .	5.140 grm	6.070 grm	13.460 grm	6.190 grm
Fixed Acids . . . . .	4.980 "	5.810 "	12.950 "	5.510 "
Fixed Ethers . . . . .	0.809 "	1.000 "	2.792 "	2.307 "
R (fixed acids : fixed ethers) . . . . .	8.4	7.9	6.3	3.2
Volatile Acids . . . . .	0.124 grm	0.214 grm	0.405 grm	0.542 grm
Volatile Ethers . . . . .	0.072 "	0.057 "	0.093 "	0.050 "
R' (volatile acids : volatile ethers) . . . . .	2.5	5.5	6.5	15.9
R'' (fixed ethers : volatile ethers) . . . . .	9.6	14.9	25.6	38.9
Total Ethers {	Fixed ethers, per cent . . . . .	90.6 %	93.7 %	96.3 %
	Volatile ethers, per cent . . . . .	9.4 %	6.3 %	3.7 %



TABLE II. — *Composition of the wine obtained with yeast 88.*

	Control	Sulphate	Phosphate	Asparagine
Alcohol . . . . .	6°0	5°4	5°2	6°0
Total acidity . . . . .	5.520 grm	5.520 grm	12.350 grm	5.970 grm
Fixed acids . . . . .	5.190 "	5.260 "	12.080 "	5.410 "
Fixed ethers . . . . .	1.331 "	1.307 "	2.235 "	2.443 "
R (Fixed acids : fixed ethers) . . . . .	<b>5.3</b>	<b>5.7</b>	<b>7.4</b>	<b>3.0</b>
Volatile acids . . . . .	0.263 grm	0.208 grm	0.241 grm	0.449 grm
Volatile ethers . . . . .	0.057 "	0.042 "	0.071 "	0.071 "
R' (volatile acids: Volatile ethers) . . . . .	<b>6.7</b>	<b>7.1</b>	<b>5.0</b>	<b>9.3</b>
R'' (fixed ethers: Volatile ethers) . . . . .	<b>19.8</b>	<b>26.6</b>	<b>26.9</b>	<b>29.4</b>
Total Ethers {	Fixed ethers, per cent. . . . .	95.4 %	93.3 %	96.7 %
	Volatile ethers, per cent. . . . .	4.6 %	3.7 %	3.3 %

TABLE III. — *Composition of the wine obtained with yeast 255.*

	Control	Sulphate	Phosphate	Asparagine
Alcohol . . . . .	2°1	2°1	2°1	2°1
Total acidity . . . . .	6.550 grm	6.930 grm	12.290 grm	7.360 grm
Fixed acids . . . . .	5.262 "	5.510 "	11.030 "	5.940 "
Fixed ethers . . . . .	2.460 "	2.389 "	2.312 "	2.755 "
R (fixed acids : fixed ethers) . . . . .	<b>6.3</b>	<b>6.7</b>	<b>6.7</b>	<b>2.4</b>
Volatile Acids . . . . .	1.030 grm	1.134 grm	1.203 grm	1.134 grm
Volatile ethers . . . . .	0.169 "	0.244 "	0.325 "	0.315 "
R' (volatile acids: volatile ethers) . . . . .	<b>8.9</b>	<b>6.8</b>	<b>5.4</b>	<b>5.3</b>
R'' (Fixed ethers: Volatile ethers) . . . . .	<b>12.4</b>	<b>8.4</b>	<b>6.5</b>	<b>7.4</b>
Total Ethers {	Fixed ethers, per cent. . . . .	91.8 %	89.3 %	88.3 %
	Volatile ethers, per cent. . . . .	8.2 %	10.7 %	11.7 %

These tables show, not only the difference in action of the three yeasts but also the influence of the form in which the nitrogen was supplied. The results of yeast 7 (Saint Emilion) are near to those of yeast 32, while showing certain differences as regards the influence of the phosphate and asparagine; yeast 94 of Burgundy showed much resemblance to yeast 88 of Burgundy, but it differed by the low fixed ether content in the asparagine test; the ratio R'' fell to 13.1. When a strong 88 yeast and a pointed 255 yeast are sown in the same medium, the first gains the upper hand; nevertheless the presence of this pointed yeast is shown by the increase of volatile ethers and acids. In this case the ratio R'' (fixed ethers : volatile ether) found by experiment and also calculated by taking the average results found for each yeast separately are shown in Table IV.

TABLE IV. — *Value of the ratio R''*

	Control	Sulphate	Phosphate	Asparagine
Yeast 88 . . . . .	19.8	26.6	26.9	29.4
Yeast 255 . . . . .	12.4	8.4	6.1	7.4
Value of R'' calculated for wine obtained by using 88+255 . . . . .	16.1	17.5	16.5	18.4
Experimental value of R'' for wine obtained by using 88+255 . . . . .	16.2	16.8	10.1	18.2

The series *A* showed that the different yeasts could subsist with only small quantities of nitrogen, the ratio between the nitrogen and the invert sugar on the control being  $\frac{1}{608}$ . In a second series *B* the sugar content was increased by adding 100 grm of saccharose per litre of must, the ratio between the nitrogen and the invert sugar of the control becoming  $\frac{1}{1102}$ . In the series *B*, a comparison was made between two yeasts of white vintages and which were more accustomed to a high percentage of alcohol: Folle blanche yeast N° 101 of Cognac, that of Sauterne N° 42, as well as 32 yeast of Langlade, coming from black grapes.

The amount of nitrogen added in the three forms was the same in series *B* as in series *A* (1 % of nitrogen). In a third series *C*, the sugar content being the same as in *B*, the nitrogen content provided by all three compounds was increased to 1.7 % and the action of yeast 32 was studied.

Table V shows the general results of these experiments.

TABLE V. — *Modifications, due to the different nitrogenous compounds, in the wines obtained by the action of yeast 32.*

Media	Fixed acids			Volatile acids			Fixed ethers			Volatile ethers		
	Series A	Series B	Series C	Series A	Series B	Series C	Series A	Series B	Series C	Series A	Series B	Series C
Control must. . .	100	100	100	100	100	100	100	100	100	100	100	100
Sulphate media. .	116	98	94	172	60	79	123	106	103	79	103	175
Phosphate media .	117	102	122	326	120	100	345	174	149	129	113	350
Asparagine media .	110	98	102	437	120	109	285	129	202	69	106	91

This study shows that the different yeasts behave very differently as regards their food nitrogen, while the nature of that element has a marked influence on their power of producing ethers. The wine maker who uses

selected yeast, whether in the first fermentation or in the second, to obtain a certain commercial result, can thus aid etherification by adding nitrogen as sulphate or phosphate of ammonia; the etherifying and synthetic powers of the yeasts are susceptible of improvement.

86 -- **The Relationships between the Development of the Flowers of Wine and the Watering of Wine** (1).—PEROTTI R. and BERNARDINI F., in *Le Stazioni sperimentali agrarie italiane*, Vol. XLIX, Part 9-10, pp. 437-496, 6 fig. Modena, 1916.

Work carried out at the Royal Laboratory of Agricultural Bacteriology and at the Municipal Chemical Laboratory of Rome, with the object of ascertaining the scientific value of the popular opinion that the development of the flowers of wine (*Mycoderma vini*) is an indication of their watering, and if this is so, within what limits the progress of development can serve to determine the watering.

The method used, and which will be used for further researches is thus described:

With a filtered sample of wine, a series of 9 samples are prepared diluted progressively at the rate of 10 per cent. 50 cc. samples are taken from the original wine and from each of the 9 dilutions, each 50 cc. being poured into a sterile 500 cc. Erlenmeyer flask. The amount of liquid taken should never be higher (100 cc.) save in the case when the maximum weight of flowers to be obtained is less than 20-30 mgr. Each sample is inoculated with 1 cc. of a mixture of pure cultures of different varieties of *Mycoderma vini*, and the flasks, stoppered with cotton wool are kept in an incubator at 28° C. After 5 days of incubation each liquid is filtered through a tared filter, and the precipitate is washed. It is then dried in an oven at 110° C. for an hour, and weighed. The resulting weight is considered as consisting entirely of the dried *Mycoderma* developed in the liquid, and a curve is plotted using the weights as ordinates, and the degree of watering of the liquid as abscissae.

Using 20 specimens of wine whose purity was not questioned, the following results were obtained:

1) Sweet, natural wines are found to contain the flowers without having been watered.

2) The dried body weight of *Mycoderma* in sweet wine reaches the maximum in a pure sample, it decreases slowly as the dilution progresses. When the watering has reached 50 per cent, it decreases rapidly.

3) Natural dry wines act differently to sweet wines as regards the development of *Mycoderma vini*. In pure, unwatered dry wines, the flowers do not develop after 5 days under the most favourable conditions. In a progressive series of dilutions of the same pure, dry wine, the dry weight of the flowers produced is shown by the path of a curve whose culminating point approximately corresponds to a medium watering (40 to 60 per cent).

4) The presence of relatively small quantities of sugars in certain pure

(1) See also *B.*, 1915, No. 152.

(Ed.)



wines, does not cause, so far as these researches are concerned, a behaviour different to that of dry wines.

5) In the highest terms of the water dilutions of a pure, dry wine, there develops along with *Mycoderma vini* the *Bacterium aceti* which has no influence on the previous phenomena, in the sense that its action is equal for all the samples ; also the results remain comparable.

6) The curves of the dry weight of the flowers, plotted for 2 series of water dilutions : a) of a pure dry wine, and b) of the same wine adulterated by adding 25 per cent of water, are different in so much as the curve of the watered wine shows a characteristic and noticeable deviation.

7) The average dry weight of the flowers produced in 17 samples of pure dry wine that were studied, show 3 characteristics in the resulting curve :

- a) a slight increase corresponding to the 10 per cent dilution.
- b) a rapid increase with the 20 per cent dilution.
- c) a slow decrease between the dilutions ranging between 50 and 90 per cent.

87 - **The Analysis of Hungarian Wines, and the Minimum and Maximum Content of their Principal Constituents.** — VUK M., in *Zeitschrift für Untersuchung der Nahrungs- und Genussmittel*, Vol. 32, Part 5, pp. 227-229. Munster i. W., September 1, 1916.

The results of maxima and minima ascertained between 1909 to 1916 at the Hungarian Station of Chemistry at Budapest, which yearly receives a thousand different samples of wine for analysis. The analysis was made according to the methods usually employed in Germany. The results are as follows :

Constituents	Contents	
	maxima	minima
Alcohol . . . . .	18.44% by volume in Kecske- meter. Muscat, Ottoriel wines, in 1907.	4.83 % by volume in a white wine of Nagykanizsa, in 1912.
Total acidity (calculated as tartaric acid) . . . .	1.53 grm. per 100 cc. of a white wine of Stridofar- kashegy of 1912.	0.30 grm. per 100 cc. of a Kecskemeter - Muscateller Wine, of 1908.
Total extract . . . . .	33.73 grm. per 100 cc. of a Tolesvaer wine, of 1901.	1.42 grm per 100 cc. of a white Versecz wine. of 1911.
Sugar-free extract . . . .	9.61 grm. per 100 cc. of Bo- drogkeresztur wine, of 1906.	1.42 grm. per 100 cc. of a white Versecz wine, of 1911.
Glycerine . . . . .	1.92 grm. per 100 cc. of a To- lesvaer wine, of 1906.	0.29 grm. per 100 cc. of a Al- soseged wine, of 1912.
Ash . . . . .	0.91 grm. per 100 cc. of an Oporto wine from Fehertem- plon, of 1908.	0.09 grm. per 100 cc. of a white Magyaraeder wine, of 1908.
Phosphoric anhydride . .	0.153 grm. per 100 cc. of a Fehertemplon wine, of 1913.	0.005 grm. per 100 cc. of a se- cond class Mezökövesder wine, of 1913.

88 - **The Filtration of the Lees of Wine.** — See No. 76 of this *Bulletin*.

89 - **Large Scale Sulphuring of Wines and Musts by Sulphur Dioxide produced directly by Burning Sulphur.** — See No. 75 of this *Bulletin*.

90 - **Earth-nut Oil and Cake.** — See No. 39 of this *Bulletin*.

91 - **The Value of Seaweed as Raw Material for Chemical Industry.** — HENDRICK J., in *Journal of the Society of Chemical Industry*, Vol: XXXV, No. 10, pp. 565-574. London 1916 (1).

The writer considers the utilisation of seaweeds on the coasts of Scotland with a view to the possible development of this industry by means of a better organisation provided with more capital.

He gives a large number of analyses which allow the estimation of the averages set forth in the following Table.

*Average amounts of ash, potash and iodine in some seaweeds:*

Seaweeds	Number of specimens analysed	Ash in undried seaweeds	Potash in the ash	Iodine in the ash
<i>Laminaria digitata</i> stems . . . . .	15	6.09 %	29.89 %	1.548 %
"    "    fronds . . . . .	12	5.31	23.34	1.697
<i>Laminaria stenophylla</i> stems . . . . .	8	5.75	33.73	1.045
"    "    fronds . . . . .	8	4.72	19.90	1.364
<i>Fucus nodosus</i> . . . . .	10	6.19	12.86	0.418
<i>Fucus vesiculosus</i> . . . . .	8	6.38	14.95	0.177
<i>Fucus serratus</i> . . . . .	8	5.60	17.57	0.220

This table shows that the stems of *Laminaria digitata* and of *L. stenophylla* are rich in potash and iodine, and they are the most likely seaweeds to form the basis of a permanent chemical industry. The *Fucus* family are less rich in potash and are very poor in iodine, but are, however, sufficiently rich in potash to make it worth while, during the present scarcity of that substance, to prepare ash from them for use as potash manure.

Experiments were made to find to what extent the potash and iodine could be extracted from *Laminaria* spp. without burning the seaweed. It was found that these two substances can be completely extracted from *Laminaria* in solution if the seaweed is first heated under pressure to about 150° C. The iodine can be readily distilled from the solution so obtained, but as there is much organic matter present, it is more difficult to recover the potash salts.

Analyses of *Laminaria* which had been dried in the ordinary manner, but with great care, and without any excessive exposure to weather, indi-

cate that very serious loss of potash and iodine takes place during the drying of the seaweed. On this account, the writer advises this operation being carried out under cheap shelters and suggests that the seaweed could also be burnt under cover and the heat of the combustion used to assist in the preliminary drying. He further proposes that drying experiments should be made on a large scale and their cost estimated.

The losses which take place during burning also require to be determined by large scale experiments. The results of laboratory experiments show that *Laminariae* may be burned at a full red heat till the ash is quite fused, without any serious loss of either potash or iodine, provided the seaweed is not mixed with any impurities, such as silica or lime, but if the latter substances are heated slowly for a considerable time together with the seaweed, there will be considerable loss of both potash and iodine; it is important therefore that in gathering the seaweed all admixture with sand should be avoided.

The writer recommends that the example of Japan should be followed. This country has organised a seaweed industry and is able to export large quantities of iodine; it also produces abundance of potash salts. It would also be well to imitate the manner in which the United States are dealing with the question of the Pacific seaweeds, and to undertake researches with sufficient funds and an adequate Staff, in order to solve the many scientific and technical questions with a view to founding a really efficient seaweed industry in Scotland.

92 -- **The Preparation and Uses of Wood Flour.** — KRESSMANN F. W., in *Scientific American*, Vol. LXXXII, No. 2127, p. 229. New-York, October 7, 1916.

Wood flour is ground or milled wood that has been screened so as to remove coarse particles and also to give a certain uniformity of size. It is usually sold as 40, 60, or 80 mesh (bronze wire screens having 40, 60, or 80 meshes per linear inch. In one specification, 20 per cent of the flour must pass through an 80 mesh, 50 per cent through a 60 mesh, and 100 per cent through a 50 mesh screen.

A good wood flour must be white, light and fluffy, and absorptive. Industries using it require a white or very light cream-coloured flour, although absorptive qualities are only specially required for making dynamite. Colour and weight considerations thus limit the species of wood to be used to the white, light, non-resinous conifers and to the white, broad-leaved woods like aspen and poplar. Spruce, white pine, and poplar are the species most often used. The wood must be barked before grinding, and round wood, barked slabs and sawdust free from bark may be used.

The wood is ground either in stone mills, or in steel burr roller mills. In Europe, particularly Scandinavia, where a good deal of wood flour is made, stone mills seem to be used exclusively and most of the early plants in the United States use this type of mill. The stones are from 40 to 60 ins. in diameter, and only the lower stone is driven, the upper one remaining stationary. Hydraulic turbines are used, as flour produced by other sources of power cannot compete with Norwegian flour ground by water power. The wood after barking is reduced to chip by the usual type of



chipper. These chips along with a certain proportion of the screenings are fed to the mills which are completely enclosed (with the exception of an opening at the top) with an iron or steel cover. Sufficient steam or water is added to prevent firing and to keep down the dust. The fine stuff from the mill is then drawn or blown through iron pipes or sheet metal ducts to the screening apparatus, which may be of several types and which may be either bronze wire or silk bolting cloth. After screening, the flour is packed in compressed bales or sacked and weighed automatically. Mills of this type require from 45 to 50 HP per 24 hrs per ton of flour produced, that is, about the same power requirement as for mechanical wood pulp.

Another type of mill was developed on the Pacific Coast about 25 years ago, being designed to handle sawdust as raw material. This grinder consists of a number of pairs of corrugated chilled steel rolls which turn towards each other. One roll turns three times as fast as the other, thereby actually cutting the sawdust as it passes through. The slower mill has its corrugations so arranged as to form pockets to hold the dust while the faster roll cuts.

There are three stands of rolls, the corrugations becoming progressively finer on each stand.

The sawdust is screened before reaching the first rolls so as to remove slivers, small blocks, etc. Then it is passed over a strong electro-magnet to pick out any iron present, and is also screened through bolting cloth to remove material of suitable fineness. The production of wood flour from sawdust in this type of mill requires only from 20 to 25 per cent. of the power required with stone mills.

Before the war, wood flour was delivered at the Atlantic ports of the United States for from \$ 12.50 to \$ 15.00 per ton, and domestic material had to compete against this. The production in the United States is mostly controlled by one firm, though mills are scattered all over the country from Maine to California.

Wood flour is principally used in the manufacture of dynamite, linoleum, artificial plastics and flooring, and as an inert absorbent in many industries.

In 1909, the amount of wood flour used for making dynamite amounted to about 20 million pounds, and is increasing every year.

Linoleum is made of either cork flour or wood flour mixed with a cementing material which is spread out on cloth on rolled in or compressed thereon hydraulically. Only wood flour is used for making inlaid linoleum because it allows of dyeing to any colour and then is permanent. The cement is made of oxidised linseed oil melted with rosin and Kauri gum. The cement is the most expensive constituent, as it costs from \$ 125.00 to \$ 175.00 per ton, depending on the price of linseed oil. Naturally the lightest flour produces the greatest volume of goods, for the raw materials of linoleum are bought by weight and sold by volume. Thus the weight per cubic foot, together with the colour, is of prime consideration to the manufacturer. Wood flour is, for this purpose, about 50 % better than cork flour.

Before the war, cork waste cost \$35.00 per ton, costing about \$5.00

to grind it with power costing 1.5 cents per kilowatt. Practically all cork flour used in the United States is manufactured in the country either from domestic waste or waste from Spanish cork mills. Cork flour is, therefore, worth about three times as much as wood flour; but since they both require equal amounts by weight of cement, and since the volume of goods produced from cork is so much greater than that from wood, the cork linoleum is cheaper for goods of equal thickness than wood flour linoleum. The latter also costs more to manufacture, requiring great expense for dies and also more labour; further it is less elastic than cork linoleum, though the wearing qualities of both are about the same.

For composition flooring, plastics, oatmeal paper, etc., the principal requirement is light colour, although in some cases certain woods are necessary as in the production of artificial bates for tanneries. The latter consists of a mixture of wood flour, ammonium chloride, and certain animal products that are absorbed by the flour. Here again the trade demands a light-coloured product, and it has been found that flour from broad leaved woods, like poplar, will cause a discolouration on storage, so that only flour from spruce or white pine may be used.

93 — **The Pasteurisation of Milk for Cheese-Making.** — STEVENSON C. and GRANT W. (Dairy Instructors, Taranaki, New Zealand), in *New Zealand Department of Agriculture, Industries and Commerce, The Journal of Agriculture*, Vol. XII, No. 6, pp. 440-445. 3 fig. Washington, June 20, 1916.

INDUSTRIES  
DEPENDENT ON  
ANIMAL  
PRODUCTS

According to the writers, (dairy-instructors at Taranaki, New Zealand) it was hitherto thought impossible to pasteurise the milk used for cheese-making on account of the large quantities of milk to be dealt with in the limited time available for the purpose, and the high cost of the necessary heating. The increase in fuel-consumption was from 15 to 20 per cent. A saving, however, can be effected by using a regenerative heater. Where water is scarce, the waste water can be cooled and used again. The best pasteurising temperature is from 71° and 75.5° C. If the temperature is raised to 79° C., or above, the addition of 1 oz to 1 1/2 oz. of hydrochloric acid per 100 gall. of milk, before adding the rennet, will be found to be an advantage.

*Benefits derived from the pasteurisation.* — The loss of milk which occurs in exceptionally warm weather of long duration is avoided.

There is a considerable increase in the amount of butter-fat incorporated in cheese made from pasteurised milk. Instances of this were observed at Taranaki, for since pasteurisation has been adopted, not a single second grade cheese has been manufactured (a large percentage being obtained before), and the factory's average grade has risen from 89 points to 92. Thus the factory saves 1/4 d per lb., which was the deduction for second grade cheeses. These satisfactory results have induced cheese manufacturers to increase the number of plants for pasteurising milk; from 7 in 1914-1915 they have increased to 32 in 1916.

A complete plant of 1 800 gallon capacity can be installed for £ 300.

It should not, however, be supposed that the good effects of pasteurisation lessen the responsibility of the farmer as regards the quality of the

milk, which will always remain the chief factor in determining the quality of the cheese made.

For instance, an experiment at Taranaki has shown that turnips fed to cows impart to the milk an unpleasant flavour which cannot be entirely eliminated by pasteurisation at 87.7° C.

94 - **On the Mechanical Protection and Conservation of Eggs.** — ARNOUX ANDRÉ, in *Comptes Rendus de l'Academie des Sciences*, 1916, 2nd. Half year, Vol. 163, No. 23, pp. 721-722. Paris, 1916.

The writer has sought a practical and cheap method for helping transport and conservation and requiring no special apparatus. To do this, the egg is wrapped in a soft envelope formed by bands of tissue which are dipped in a mineral paste that hardens and protects the egg.

Amongst the substances suitable for this, silicate of soda, already used for this purpose, gave the best results. The egg thus preserved is protected from shock and travels as if in a box. In practice the egg is still quite fresh at the end of about a month.

For consumption the egg is dipped into tepid water, when the mineral paste easily dissolves. Envelopes other than bands of tissue may be employed (wadding, saw-dust etc); and other food products are capable of being similarly protected.

95 - **The Strength of Eggshells.** — HERRASTI G., in *Scientific American*, Vol. XCV, No. 15, p. 321, 1 fig. New-York, October 7, 1916.

The strength of eggshells has been ascertained by placing them on the plate of a pair of scales and submitting them to gradual pressure by means of a lever and jack. It was found that coloured egg shells are stronger than white ones. The average breaking pressure for brown shells reached 70.37 kg., while white shells only required 51.07 kg. to break them.



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## PLANT DISEASES

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### DISEASES NOT DUE TO PARASITES OR OF UNKNOWN ORIGIN.

96 — **The Noxious Action of Sea-salt deposited on Sea-shore Plants.** — DUFRENOY JEAN, in *Comptes Rendus des séances de la Société de Biologie*, Vol. LXXIX, N°. 17, pp. 914-916 Paris, 1916.

In 1915 and 1916, researches were carried out in the Laboratory of the Biological Station at Arcachon in order to watch the progress of the mortification caused by the deposition of microscopic drops of sea water, especially on the green organs of the cluster pine (*Pinus pinaster*), Sea Holly (*Eryngium maritimum*) and Broom (*Sarothamnus scoparius*), plants growing on the sand dunes.

In such a case, the pine needles are first seen to be covered with clear, translucent, yellow spots which turn brown as they dry. Finally, on account of the difference of water content between the spots and the neighbouring healthy parts, they become twisted out of their vertical axis; and the spots, in extending, cause the ends of the needles to become deformed. On the leaves of *Eryngium* the spots are at first brown, become transparent, but remain bordered with brown. On broom, the young branches become brown, and in consequence of the disappearance of the parenchymatous bark, they are reduced to the central woody cylinder. The spots, at any rate at first, are always covered with white dust, of a salt taste, and which is composed of crystals that are seen to be chlorides from microscopical and chemical examination. The dust evidently comes from spray carried by the wind, as it is only found on exposed parts and not on those that are sheltered.

The mortification of the attacked regions commences round the stomata, the salt water having penetrated into the air-chambers. The cells are first plasmolysed: the chlorophyll grains disintegrate; the cell membranes are deformed, and being torn, allow the protoplasm to escape and collect at the stomal opening and even exude on the external surface. Cavities appear in the leaf parenchyma which collapses or wrinkles and be-

comes finally reduced to its two epidermal surfaces (1). In most cases the protecting epidermal tissues remain intact and only become involved when the contractions of the subjacent parenchyma breaks them.

The vegetative organs exposed to the sea winds are, in consequence, prevented from developing and often decayed during their period of growth. The organs on the unexposed side alone can develop in the shelter of the dried-up remains of the organs facing to wards the sea. The plants consequently assume a characteristic dissymmetric shape.

### DISEASES DUE TO FUNGI, BACTERIA AND OTHER LOWER PLANTS.

#### GENERALITIES.

- 97 - On the Hibernation and Spread of Cereal "Rusts" in Sub-tropical Climates. — GASSNER GUSTAV, in *Zeitschrift für Pflanzenkrankheiten*, Year 1916, Vol. 26, Parts 6-7, pp. 329-374. Stuttgart, Sept. 16, 1916.

The observations upon which the present paper is based were made during the period 1907-1910, in the eastern portion of South America (Uruguay, Argentine, Southern Brazil) where the climate is subtropical and "rusts" appear regularly every year. However, not all the European species of these fungi occur, South America only possessing *Puccinia graminis*, *P. triticea*, *P. coronifera* and *P. Maydis*. Nevertheless, in view of the international nature of the "rust" problem the observations made in this region still possess a general interest.

The principal results of this very thorough research were as follows:

- 1) The cereal "rusts" of tropical South America (*P. triticea*, *P. coronifera*, *P. graminis*, *P. Maydis*) appear in uniform manner but are differentiated among each other by the method of wintering.
- 2) In the case of *P. triticea* and *P. coronifera* it is the uredospores which hibernate, and new formation of spores and fresh infections are observed throughout the winter.
- 3) In the case of *P. Maydis*, wintering of the uredospores is unknown as there is no winter maize in subtropical climates.
- 4) Nor in the case of *P. graminis* has any wintering of uredospores been observed. The host plants of this "rust" are nevertheless very numerous during the subtropical winter, but their environment or state of development are such that they are not infected by the uredospores.
- 5) Nevertheless, there is a very slight possibility that germinating uredospores of *P. graminis* may develop during the winter on well sheltered growing plants, or may hibernate among vegetable refuse.
- 6) Neither for *P. graminis* or other species of "rusts" have any conclusive facts been ascertained as to wintering by means of mycelia in plant tissues.

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(1) A transverse section through the edges of the spots shows all the stages between healthy and completely deformed cells.

7) Notwithstanding the regular formation of teleutospores, no case of wintering by means of teleutospores and change of host has been observed either for *P. graminis* and *P. Maydis*, nor for *P. triticina* and *P. coronifera*.

8) Nor has any case been observed of wintering and transmission of "rust" by means of the grain. Especially striking is the absence of facts in favour of ERIKSSON'S "mycoplasma" hypothesis. But no endeavour was made to ascertain possible cases of transmission by means of spores or mycelium attached to the grain, that is to say, with the exception of a series of isolated experiments which it is necessary to repeat.

9) From what has been said in paragraphs 3-8 it follows that *P. graminis* and *P. maydis* have not been proved to hibernate in the sub-tropical climate of Uruguay. It must therefore be considered that these "rusts" pass the winter in another country and that they are transmitted every year by means of air currents.

10) This supposition finds a certain amount of support in the fact that *P. graminis* hibernates in the form of uredospores in Southern Brazil only, whilst in tropical Brazil uredospores of *P. Maydis* have been found at periods when no maize fields are in existence in the Southern sub-tropical part of the country.

11) Proofs have also been forthcoming in support of the transmission of "rusts" by air currents. In order to appreciate this method of transmission, account must be taken of the extent of the area under cereals. In countries producing a large amount of grain the big areas lend themselves admirably to the reception of spores; these latter may still contribute towards the transmission of the "rust" even in those cases where, owing to the smallness of their numbers, it is not possible to determine the presence of spores in the atmosphere of means by the methods of capture in use ("Pilz-fallen").

98 - **Biological Observations on *Roestelia cancellata*, a Rust attacking the Pear.** —

TROTTER A., in *Rivista di Patologia vegetale*, VIIIth year, N° 3, pp. 65-76 Pavia, 1916.

*Roestelia cancellata* (Jacq.) Reb., the aecidial form of *Gymnosporangium Sabinae* (Dicks.) Wint., develops yearly in more or less abundance on the different varieties of pear trees cultivated in the neighbourhood of Avellino (Italy). As is already known, *R. cancellata* exists in connection with *Juniperus Sabina* L. on the branches of which plant there is produced annually the form with teleutospores (*Gym. Sabinae*) the agent producing the infection on the pear tree. The author's investigations have determined the presence, in the neighbourhood of Avellino, of specimens of *G. Sabina* which are annually infected with *Gymnosporangium*.

This form bearing teleutospores appears as early as January and reaches its full development at the end of March or the beginning of April. Owing to the quantity of fine rain which almost invariably falls at this period, the sori bearing the teleutospores undergo a process of gelatinisation. During the course of this latter following the germination of the teleutospores, sporidioles (basidiospores) are formed at the surface of the sori.



It is immediately after the period of gelatinisation that the fungus begins to become infectious for the pear tree, but for this tree only, which at this particular moment is in a state of receptivity to infection by the sporidioles. According to the writer, the teleutospores are of no importance from the point of view of dissemination. Plants of *Crataegus Oxyacantha*, *Pyrus Malus*, *Cydonia vulgaris*, living in the same locality infected with *Gymnosporangium*, are never attacked and they are further quite immune to artificial infection. On the other hand, such infections are always successful on the pear tree and that without there being any necessity to wound the leaves. It is sufficient to damp the surface slightly with a soft brush which has been moistened and passed over the gelatinised sori of *Gymnosporangium* in order to pick up the sporidioles.

In the case of *Gymn. Sabinae* it seems that the diffusion of the sporidioles can only be carried out by the agency of the wind, for the progressive diminution of the infection of pear trees becomes much more evident the further one proceeds from the centre of infection formed by the individuals of *Juniperus* attacked by *Gymnosporangium*.

The writer considers it not improbable that the sporidioles in suspension in the atmosphere may be forced vertically downwards by the rain and so deposited on the leaves of the pear tree.

The results of experiments in artificial inoculation and the behaviour of the fungus in nature have led the writer to the belief that the best period for treatment with fungicides having copper salts as their basis (in relation to the fungus) is that extending from the time of gelatinisation of the sori bearing the teleutospores till the complete dispersal of the sporidioles. In relation to the plant the best period is that comprised between the appearance of the first shoots and the development of the first wood-buds; in relation to the weather (approximately) the period covering the first few days of April and the end of May. During this period, two, or at the very most, 3 treatments at intervals of a fortnight, should be sufficient to deal with *Roestelia*.

Experiments were also made to determine whether it is possible for the mycelium of *Roestelia* to penetrate the branches of the pear tree and establish itself in this way. In this connection several pear tree were chosen which every year without fail were badly attacked by *Roestelia*. After establishing that release of the sporidioles should not occur before April 15, 1915, the writer protected one of these trees by means of a cloth tent, in such a way as to give effective protection against infection from outside. In the case of another plant growing in the neighbourhood of the first, several buds were enveloped in small bags of parchment. On the 4<sup>th</sup> July, both parchment bags and cloth tent were removed and it was found that the measures taken were so effective that neither tree showed the slightest trace of *Roestelia*.

As a consequence of this experiment it seems definitely settled that in normal conditions at least there is no hibernation, and still more definitely that there is no question of *Roestelia* establishing itself by means of a mycelium. It follows, therefore, that the infection must be renewed

annually by means of the sporidioles of *Gymnosporangium* derived from *G. Sabina* and other related species which may also eventually act as hosts for this fungus (*G. Oxycedrus*, *G. phoenicea*, *J. virginiana*, *G. Japonica*, *G. macrocarpa*, *G. tripartita*, *G. excelsa*).

If, in view of what has been said, *J. Sabina*, or allied species are found to any great extent as constituent elements of woods or thickets and it is not considered advisable to destroy them, recourse must be had to the control of *Roestelia* by means of fungicides at the most opportune period as discussed above. Where *J. Sabina* and closely related species only, occur sporadically, being cultivated for ornamental purposes, the writer advises the adoption of legal measures to enforce destruction.

99 - *Castanea mollissima*, a Chinese Chestnut tree Resistant to *Endothia parasitica*. — See No. 18 of this Bulletin. ®

RESISTANT  
PLANTS

100 - "Uspulun" a New Preparation for the Treatment of Cereal Grains against Fungoid Diseases (1). — WEEK in *Illustrierte landwirtschaftliche Zeitung*, 36th year, No. 82, p. 552. Berlin, 1916.

MEANS  
OF PREVENTION  
AND CONTROL

A new preparation for the treatment seed of grain known as "Uspulun", has been placed upon the market and is said to be capable of destroying all fungal spores occurring on the surface of the grain. The diseases in view are chiefly "stinking smut of wheat", the *Fusarium* attacking wheat and rye, *Helminthosporium gramineum* of barley and, according to ERIKSSON, "loose smut of oats" (*Ustilago avenae*). The remedy might also be adopted for seeds attacked by bean anthracnose (*Gloeosporium Lindemuthianum*) and pea anthracnose (*Ascochyta Pisi*).

The active principle contained in the remedy is chlorophenate of mercury, in the proportion of about 20 %. The remaining 80 % is made up of various agents intended to render the preparation more soluble and to protect it from moisture.

The mercury content is about 12 %. To ensure recognition of seeds treated with "Uspulun" a blue colouring matter has been added.

Experiments covering a period of 3 years have been carried out at the Agronomical Institute of Giessen University in order to determine the effect of "Uspulun" treatment on the germination of the seeds and on the action of the fungi during germination.

It was also wished to determine whethen "Uspulun" really constitutes an effective remedy for the control of "stinking smut". If so, the next question to be studied is that of expense. For comparative purposes, the seeds were also treated with copper sulphate, formalin and sublimate.

I. — *Effect on Germination and Action of the Fungi*. — The seeds were immersed in the "Uspulun" solution and allowed to remain there for some time. No spraying was carried out, the effect of the solution on the germination capacity being less marked by this method than by the immersion process.

(1) See also B. Oct. 1916, No. 1146.

(Ed.).



The germination energy ("Keimenergie") and germination capacity ("Keimkraft") of rye and barley were increased several degrees by the treatment with "Uspulun".

The germination energy shows a stronger increase than the germination capacity. The reason is to be found in the destruction of the fungi, especially of *Fusarium*, which impeded the course of germination in the non-treated samples.

The favourable effects of the treatment were shown still more distinctly in the case of the determination of the growth capacity ("Triebfähigkeit"). The optimum value of concentration of the solution was almost in every case from 1 : 200 and 1 : 900 (the instructions given by the manufacturers say : 1 : 300). Rye forms an exception as its germination energy only shows an increase with the weakest of all the solutions i. e. 1 : 800. Treatment with "Uspulun" produces no increase in the germination capacity or in the growth capacity of barley and oats.

Sublimate (15 minutes immersion in a 0.1 % solution) diminished the germination energy of wheat. On the other hand the germination capacity remained unchanged. There was a distinct increase in the growth capacity in comparison with the non-treated samples, as was also the case with Uspulun ; this increase, however, was 20 % less than with "Uspulun". The germination capacity and the growth capacity were the same as those of the samples treated with "Uspulun". The growth energy and the growth capacity showed an increase of nearly 10 % on those of the non-treated samples.

The treatment with sublimate had no adverse action whatever on the germination capacity and growth capacity of barley and oats ; however, it lowered the germination energy of the barley.

The wheat grains seemed to have suffered no damage from an immersion of a quarter of an hour in a 0.1 % solution of formalin. The germination capacity and the germination energy remained the same as for the non-treated seeds. On the other hand there was a big difference in the growth capacity.

The effect of formalin on rye was similar. The germination value ("Keimwert") was slightly diminished for oats and remained unchanged for barley.

Copper sulphate (0.5 % solution ; 15 hours immersion) usually had a very deleterious effect on the germination of rye and wheat.

It is true that a subsequent treatment with milk of lime caused an appreciable improvement in all the factors, however, they were superior to these of the untreated samples in one single case only (growth capacity of wheat). The results of treatment with copper sulphate were no better for barley and oats, although in this case also, the factors may all have been considerably improved by a subsequent treatment of the seeds with milk of lime.

Treatment with "Uspulun" surpasses all the other methods examined. Next comes corrosive sublimate, and then formalin and finally copper sulphate, with and without treatment with milk of lime.



II. — “*Uspulun*” as a remedy for “stinking smut”. As early as 1915, field trials were made on the control of “stinking smut” and “loose smut of oats” but without result owing to the failure to produce artificial infection by means of spores. A new attempt was made in 1915 with autumn wheat severely attacked by “stinking smut” and this time the experiment was successful. The results are as follows:

Treatment of seed		Growth	Proportion of wheat attacked by stinking smut
Untreated	washed	good. . . . .	37.8
	dry	” . . . . .	50.8
” <i>Uspu-</i> <i>lun</i> ”	immersed	very good . . . . .	0.0
	sprayed	” . . . . .	1.5
Sublimate	immersed	slightly irregular . . . . .	0.0
Copper sulphate	”	irregular with gaps . . . . .	0.0
Copper sulphate followed by treatment with milk of lime . . . . .		good. . . . .	0.27
Formalin . . . . .	”	good. . . . .	0.1

The expenses of treatment with “*Uspulun*”, when the spraying method is adopted, are from 3  $\frac{1}{4}$  d. to 4 d. per acre for wheat; from 2  $\frac{1}{4}$  d to 3 d. per acre for rye. The immersion method comes dearer for small quantities of seed, but comes as low as 4 d. per acre for large quantities.

101 — *Puccinia glumarum* on Wheat in Salt Lake Valley, Utah, U. S. A. — O’ GARA P. J., in *Science*, New Series, Vol. XLIV, No. 1139, pp. 610-611, Lancaster, Pa., 1916.

DISEASES  
OF VARIOUS  
CROPS

Towards the end of June 1915, the author and MR W. W. JONES discovered an apparently new rust on wheat in fields to the North W. of Ogden (Utah). The infection seemed to be considerable.

Examination of the specimens showed that the rust was *Puccinia glumarum* Erikss. and Henn, already reported at Sacaton (Arizona).

Work will be carried out on the presence and distribution of this “rust” and the damage it causes to wheat in Salt Lake valley and the surrounding district.

102 — *Bacillus Omelianskii* n. sp. as the Cause of “Bacillary Gummosis” of Sorghum. — СЕРВИНОВ И. Л. (SERBINOV I. L.), in *Болезни растений, журнал Центральной Фитопатологической станции Императорскаго Ботаническаго Сада Петра Великаго*. (*Plant Diseases. Bulletin of the Central Station of Phytopathology of the Peter the Great Imperial Botanical Garden*), Nos. 4-5, pp. 95-113. Petrograd, 1915.

In July 1915, the Central Phytopathological Station of the Peter the Great Imperial Botanical Garden received from M. N. G. ZAPROMETOV three entire plants of sorghum attacked by a disease which was subsequently identified as being perfectly new and was named by the present writer “bacillary gummosis”. These plants were derived from three fields belonging to the Experiment Station of Golodnaja Steppa (region of Samarkand), throughout which the disease occurred on a large scale.

According to the writer, the disease showed the same symptoms on all three plants in question: the neck was the part attacked, the roots remaining perfectly healthy. According to M. ZAPROMETOV, the disease also attacks the roots. The neck of the plant turns black, gives off a characteristic smell of butyric acid and is affected with damp rot. The tissues of the diseased portion become so macerated that at certain points they may easily be separated cell by cell by means of a needle. The diseased portions secrete a brownish black dense mucous substance of syrup-like consistency which fills the intercellular spaces.

No bacteria have been observed in the cells of the diseased portions, but the intercellular spaces, on the other hand, were full of the new butyric bacteria called by the author *Bacillus Omelianskii*. In a few cases minute-butyric non-sporing bacteria of the *Clostridium* type were observed but the chief mass of the bacteria belonged to *B. Omelianskii*.

The essential feature of the disease consists in the maceration of the tissues and cells of the infected portion (pectic fermentation) and then in the butyric fermentation. Following a summary of the types of bacteriosis of Gramineae as described by other observers, the writer gives it as his opinion that the one now under discussion is new to science. The morphological and pathological changes which it produces consist chiefly in maceration of the tissues and cells, a feature which though constantly present in numerous other types of bacteriosis, has hitherto never been recorded for bacterial diseases of cereals.

The morphological characters of *B. Omelianskii* are as follows: length  $0.85 - 2.12 \mu$  and width  $0.85 - 1.27 \mu$ ; elongated, short and almost square forms have also been observed. Occasionally twin forms are noticed. The bacterium is immobile and devoid of any motile organ. A typical feature is that it has the appearance of being truncated at the extremities. The usual size of the spores is maximum length  $0.85 \mu$ , max. width  $0.42 \mu$ . Attempts to secure a pure culture in artificial media were unsuccessful. In company with *Micrococcus candidans* the bacillus gives rise to a powerful butyric fermentation which, alone, it is incapable of producing. It stains well with methylene blue and behaves in quite a characteristic manner in relation to the GUMSA-ROMANOVSKIJ colouring method. Whereas, by this method, the majority of bacteria stain a blue colour, *B. Omelianskii* behaves differently: usually the bacteria stain a practically uniform pink and only at the moment of sporing does a portion of the protoplasm stain a blue colour. By means of this phenomenon the author has been able better to observe the process of sporing in *B. Omelianskii*: only a definite portion of the protoplasm is concerned by becoming concentrated about a given point. At the end of the sporing period the spore acquires a wall of its own, the remainder of the cell separating off and leaving at the surface of the spore a portion of the protoplasm which readily takes up aniline dyes.

Among methods of control of this new disease of sorghum, the writer recommends careful working of the surface layer of the soil, deep

working of the soil, in severe cases soil disinfection with formalin and finally, also, the choice of a suitable rotation.

Attention is drawn to the fact that "bacillary gummosis" of sorghum has been observed under conditions where there can be no question of excess of moisture, the cause of so many varieties of bacteriosis. As an explanation of this apparent contradiction, the writer observes that diametrically opposite physical and chemical agents have often the same action on bacteria and that it is probable that not only excess moisture but also drought and many other factors unfavourable to cultivation exert a similar influence on infection of the plant by bacteriosis. Finally attention is drawn to the necessity for the adoption of scientific methods in the cultivation of sorghum.

A table and bibliography with 47 references accompanies the text.

103 - **Diseases of the Sugar-beet observed in Austria-Hungary.** — See No. 12 of this *Bulletin*.

104 - **Diseases and Pests of the Coffee Plant in Reunion.** — See No. 36 of this *Bulletin*.

## INJURIOUS INSECTS AND OTHER LOWER ANIMALS.

105 - **The Control of Locusts in Various Countries.** — *International Institute of Agriculture, Bureau of Agricultural Information and Plant Diseases*. 1 vol. in 16mo., pp. XVI-187. Rome, 1916.

GENERALITIES

The control of locusts is a problem of considerable interest for a large number of countries.

In view of the practical utility of a publication which would contain as exact and complete an account as possible of all the various methods adopted throughout the world to deal with these pests, the Institute has opened an international enquiry. As a result of this enquiry a mass of information has been collected and published under one cover, thus making available a complete and up-to-date review of this important question.

As confirmation of the timely nature of the enquiry we have now received the proposal of the Director of Agriculture of the French Protectorate of Morocco, to the effect that the Institute should take the initiative in summoning an International Conference (to be held at Rome) to deal with the control of locusts.

The Permanent Committee, on the proposal of M. LOUIS DOP, Delegate for France and Colonies and Vice President of the Institute, has approved the following resolution:

"The Permanent Committee, approving the proposal of M. LOUIS DOP on behalf of the Government of Morocco to summon an International Conference at Rome, in accordance with art. 9, letter f, of the Convention of June 7, 1915, to deal with the control of locusts, has decided:

1) to adopt the principle of the proposal made by M. LOUIS DOP on behalf of the Government of Morocco;



- 2) To give effect to this proposal by inviting all the States adhering to the Institute to participate in the work of the Conference and if they think fit to send their representatives;
- 3) to hold this Conference before the next meeting of the General Assembly.
- 4) The date of the Conference is to be fixed as soon as the necessary preliminaries have been completed with regard to the various Governments interested".

For the above Conference the present publication of the Institute may serve as a preparation. This work contains data, properly coordinated, relating to 110 countries. The data relating to the few countries which have not yet been able to reply to the Institute's enquiries will be published subsequently.

The work is divided into six chapters the first of which deals with the subject from the historical point of view and treats of the distribution of locusts in the 5 continents of the world in turn.

The second chapter contains a list of the Orthoptera — more than 140 species — generally classed under the name of locusts and recorded as more or less destructive to agriculture in the various countries previously enumerated. The scientific name of each species is accompanied by the name of the locality in which the particular insect has been observed; the names of the localities most severely affected are marked by an asterisk. Wherever possible the local common name has also been given. The nomenclature and classification is founded on the well-known work of W. E. KIRBY; however, in order to avoid all chance of error, the synonyms most in use have been added in cases where such a precaution seems necessary.

Owing to their importance from the point of view of control, a long account has been given in the third chapter of all the data collected on the biology and habits of locusts. The plan here has been to give the different data referring to each single species for all the various countries where it occurs. Next comes a summary of all the data connected with the life cycles of the different species. Finally, attention has been paid to the habits of locusts in general, the time etc. of their appearance and migrations in the various countries, the causes determining the formation of swarms, migrations, reproduction and finally, their food.

The present organisation in the various countries for dealing with the pest is discussed in the chapter following as, for instance, legislative and administrative measures, among which those adopted in the British and Portuguese possessions in Africa and emanating from the "South African Central Locust Bureau" (situated temporarily at Pretoria) are particularly worthy of attention. The agreement concluded in 1913 between the countries of South America with reference to the centres of origin of *Schistocerca paranensis* is also discussed, in addition to the financial measures adopted in the various countries and other measures having their origin in private effort.

In the fifth chapter particular attention has been paid to the various methods of control, whether natural, mechanical, physical or chemical.

Chapter VI deals with the value of an international agreement as a rapid and efficient method of resolving the problem of locust control.

The work concludes with a Bibliography containing over 500 references, now properly classified for the first time. It also comprises many extracts from all kinds of publications including the most recent, which have been drawn upon to a large extent in the compilation of the work under notice.

106 — **Coccidae** observed in the Seychelles Islands. — GREEN E. E., in *Bulletin of Entomological Research*, Vol. VII, Part 2, pp. 193-196, Fig. 1-3, London, 1916.

The writer describes, chiefly from the systematic point of view, the following species which are new to science and which were sent by Mr. R. Dupont:

- 1) *Aspidiotus (Chrysomphalus) ansei* found on the leaves of the coco-

nut palm at Anse aux Pins ; 2) *Gymnaspis grandis* on fruit of "Coco de mer" (*Lodoicea sechellarum*) at Praslin ; 3) *Lepidosaphes duponti* on leaf stalks of coconut palm at Silhouette.

Since the publication (in Trans. Linn. Soc. Lond. XII, part 2, p. 197, 1907) of a list of *Coccidae* occurring in the Seychelles, the following species have been identified in collections received from Mr. Dupont :

1) *Lecanium mangiferae*, Green, : on Cinnamon and imported Mango plants ; *Aspidiotus dictyospermi pinnulifera*, Mask ; on *Jasminum*, *Thunbergia Pandanus* and Coconut ; 3) *Aspidiotus bromeliae*, Newst. : on Pine-apple plants, 4) *A. ansei* Green on *Cocos nucifera* ; 5) *Ischnaspis filiformis*, Dougl. ; on Oil Palm : 6) *Gymnaspis grandis* Green on *Lodoicea* ; 7) *Parlatoria pergandei* Comst. on *Thunbergia* ; 8) *Lepidosaphes dupont* Green on *Cocos nucifera*.

The list of species recorded from these islands is still a very small one, and the number of genera represented is extraordinarily poor. It includes *Icerya* (1 sp), *Asterolecanium* (2), *Pseudococcus* (2), *Pulvinaria* (2), *Cero-plastes* (1), *Vinsonia* (1), *Lecanium* (7), *Chionaspis* (1), *Hemichionaspis* (2), *Diaspis* (1), *Aspidiotus* (8), *Lepidosaphes* (4), *Ischnaspis* (1), *Gymnaspis* (1) and *Parlatoria* (1) ; a total of 15 genera and 35 species only. Such widely distributed genera as *Orthezia*, *Antonina*, *Ericococcus* and *Fiorinia*, are as yet unrepresented in the Seychelles.

107 - **The Fruit Flies Occurring in India, Burma, and Ceylon** (1). — BEZZI M., in *Bulletin of Entomological Research*, Vol. VII, Part 2, pp. 99-121. London, 1916.

After having given a table of the Oriental and Australian genera of *Dacinae* at present known, the writer gives a detailed description of the following species.

1) *Dacus (Leptoxyda) longistylus* Wied from Balighai, near Puri, Orissa, and some others from Coimbatore and from Nagpur, on *Calotropis*.  
2) *Dacus brevistylus* Bezzi from Hagari, Siddhout, Cuddapple, and Madras in melons.  
3) *Chaetodacus ferrugineus* F. from Peradeniya Ceylon ; from Kat-char, Purneah District North Bengal ; and from Pusa, Bihar, bred from the fruits of guava and loquat ; from Mandalay, on mango ; from Myit Kyina, Upper Burma, in peaches and pomelos (*Citrus decumana*) ; from Maymyo, Upper Burma, in larval condition in mango. 4) *Chaet. ferrugineus dorsalis* Hendel from Peradeniya ; Pusa in loquat ; Coimbatore on mango ; Tarn, Peshawar district bred from *Prunus persica* ; Mandalay in mango and chilly (*Capsicum frutescens*) ; Myit-Kyina on *Citrus decumana* and *Psidium Guayava* ; Lashio and Tatkon, Upper Burma in *Solanum verbascifolium* ; Maymyo on *Capsicum* sp. *Pyrus communis*, and *Prunus Persica* : 5) *Chaet. ferrugineus incisus* Walker, from Kuman ; Pollibetta, South Coorg, bred from "jak fruit" (*Artocarpus integrifolia*) ; from Santikoppa North Coorg from fruits of *Careya arborea* ; Bangalore on mango leaves and on the fruits of *Psidium guayava* ; Coimbatore, attacking mango fruits ; Tat-

(1) See also B. January 1915, No. 128 and B. November 1915, No. 1226.

(Ed.)



kon, Upper Burma, in *Solanum verbascifolium*; Lashio on the same plant; and Taung-gyi; 6) *Chaet. ferrugineus versicolor* var. nov. from Peradeniya; Pusa on fruits of *Ps. Guayava* and *Achras Sapota*; Coimbatore in mango fruits; 7) *Chaet. zonatus* W. W. Saunders, from Pusa on *Prunus persica*, on *Ficus* sp. cultivated, on *Achras Sapota* and from ripe fruit of *Aegle marmelos* ("Bael"); Santikoppa, from fruits of *Carega arborea*; Amnoha, Moradabad on mango fruits; Pachmarhi in peach fruits and Nagpur in *Lagenaria vulgaris*; Taru, bred from *Prunus persica*; 8) *Chaet. tuberculatus*, sp. nov. from Taung-gyi and Myitkyima, in *P. persica*; 9) *Chaet. correctus* nom. nov., Pusa from *P. persica*; Coimbatore on mango; Guindry, Madras; Hagari Bellary Dist. Madras, on a leaf of *Ricinus*; 10) *Chaet. duplicatus* n. sp. from Pachmarhi, on *P. persica*; 11) *Chaet. diversus* Coq, bred originally from oranges, observed at Pusa on "jaman leaves" (*Eugenia jambolana*), and on *Sinapis*; Bangalore on mango leaves; Machavaram Godavari Dist; Coimbatore; Nagpur on *Lagenaria vulgaris*; Dehra Dun, on grass; 12) *Chaet. maculipennis* Dol.; Coimbatore on "cholam" (*Andropogon sorghum*; Minbu, Lower Burma on *Vitis* sp.; 13) *Chaet. hageni* from Meiktila, Upper Burma, on *Cucurbita* sp.; 14) *Chaet. cucurbitae* Coq, Dehra Dun on grass; Dhoni, Krishna Valley; Poona and Calcutta; Pusa on "parol" (*Trichosanthes dioica*) in the fruits of *Cucumis*, *Momordica Charantia*, *Cucurbita* spp., in fruits of *Luffa aegyptiaca*; Lyallpur, Punjab, on *M. Charantia*; Coimbatore on *Cucurbita Melo*, *C. Pepo* and *Cucumis*; Nagpur on *Cucurbitaceae*; Tarn, larva in *M. Charantia*; Meiktila on *Cucurbita pepo*; Mandalay, Pyinmana, Tatkon, on *Cucurbitaceae*; at Talkon frequently found on fruits of *Trichosanthes cucumerina*; 15) *Chaet. caudatus* F., Dehra Dun on grass; Shevaroy Hills; Coimbatore; Bababudin Hells, Mysore; Lashio and Tatkon in larval condition in the fruits of *Trichosanthes palmata*; Myitkyina on *Citrus decumana* and at Taung-gyi; 16) *Chaet. garciniae*, Bezzi, bred at Peradeniya from *Garcinia* fruits; 17) *Chaet. scutellaris* n. sp., a single specimen from Goorghalli Estate, South Mysore; 18) *Chaet. biguttatus* sp. nov., a single specimen from Darjiling; 19) *Chaet. bipustulatus* Bezzi, from Mysore and Coonoor; 20) *Chaet. scutellaris*, Bezzi, from Almora; Kumaon; Taung-gyi; 21) *Mellessis sphaeroidalis* sp. nov. a single specimen from Dehra Dun, on grass; 22) *M. brachycera* sp. nov., a single specimen from Dehra Dun, Bhimtal Kumtal; 23) *M. crabroniformis*, Bezzi, from Yerkaud, Shevaroy Hills; 24) *M. distillatoria* a single specimen, from Bhamo, Burma; 25) *M. eumenoides*, sp. nov. from Tatkon, bred from fruits of *Trichosanthes cucumerina* and one from Myitkyina obtained from cucumber; 26) *Adrama austeni*, Hendel, one specimen collected at Peradeniya.

The writer also gives a list of the host plants and the species feeding on them.

108 - On a species of *Dibrachys*, a Chalcid Parasitic of the "Grain Weevil" (*Calandria granaria*). — BURCKART F., in *Centralblatt für Bakteriologie, Parasitenkunde und Infektionskrankheiten*, Vol. 46, No 22-23, pp. 502-504. Jena, November 1, 1916.

The Author has bred out hymenoptera belonging to the Chalcididae from the weevil *Calandria granaria* kept in breeding cages. SCHMIEDEK-



NECHT of Blankenburg identified them as belonging to the genus *Dibrachys* (subfam. *Pteromalinae*) of which three species are known — *D. acutus* Thomson, *D. affinis* Masi and *D. boucheanes* Ratzeburg, but it comes closest to *D. acutus*.

Seen with the naked eye, the body appears black, but microscopic examination shows that it is clearly bluish. The sexes are distinguished by the fact that in the male the abdomen is quite bluish, while in the female it is darker. The colour of the extremities, which is a characteristic of this insect, is brownish-yellow. In addition, shades varying from clear yellow to dark brown can be seen. The study of a single insect is thus insufficient to identify the species from this character alone. The insect in question is distinguished from *D. acutus* by the fact that the antennae are more pubescent.

The thorax also is strongly hairy. The size and shape of the abdomen are sufficient to permit the unaided eye to separate the two sexes of the insect. In fact, the abdomen of the male is hardly any broader or bigger than the thorax, while the opposite is the case in the female.

No observations were made on the biology of this insect, and the part it plays as a parasite is also unknown. Several parasites of *Calandra granaria* are recorded (*Chremylus rubiginosus* Nees, *Cerocephala cornigera* Westw., *Pteromalus calandreae* Howard, *Meraporus* sp.) to which must be added the *Dibrachys* described by the Author.

109 — ***Thersilochus conotracheli*, an Ichneumonid Parasite of the Plum Curculio (*Conotrachelus nenuphar*).** — CUSHMAN R. A., in *Journal of Agricultural Research*, Vol. VI, No 22, pp. 847-855. 9 figs. plate CIX. Washington, August 28, 1916.

During the seasons of 1914 and 1915, the ichneumon *Thersilochus conotracheli* Riley has been the most abundant and effective parasite of the plum curculio (*Conotrachelus nenuphar*) Herbst at North East, Pa. As far as is known, this ichneumon only attacks the plum curculio, as it has been reared from this host in Connecticut, New York, New Jersey, Pennsylvania, Illinois, Missouri, Kansas, and Michigan.

The parasite is single-brooded, the life cycle of one generation extending over a year. The adult stage is reached in autumn, but the adults do not emerge until late May to the middle of June. The females emerge later than the males but live longer than the latter. The curculio larva is usually attacked while still small, from hatching till burrowing into the fruit. The egg deposited in the body of the larva hatches in about 6 days and the newly hatched larva lives as an internal parasite lying free within the body cavity of its host. More than one parasite may be found in a single host, but normally only one is successful. When the parasite is nearly full grown, it leaves its host and feeds externally on the body of its victim.

Detailed description of the various stages are given, together with figures.

It appears from this work that *Thersilochus* does not begin oviposition until some time after the curculio has begun to attack the fruit, and

therefore does not exercise any control over the early larvae of *Conotrachelus nenuphar*.

9 references are given at the close of the paper in the bibliography.

- 110 - *Prospaltella fasciata* n. sp., a Chalcid Parasite of the Scale Insect *Chrysomphalus dictyospermi*, in Italy (1). — MALENOTTIETTORE, in *Redia*, Vol. XII, Part 1, pp. 195-196, 1 Fig., Florence, 1916.

A systematic description of *Prospaltella fasciata* n. sp. The Author has collected several females of this hymenopteron, parasitic on the scale insect *Chrysomphalus dictyospermi* living on *Sansevieria arborescens*, in a hot-house in Florence. The male of this chalcid is as yet unknown. The new species approximates to *P. lutea* Masi.

- 111 - A New Remedy for the Successful Control of *Elateridae*. — STEHLIK W., in *Blätter für Zuckerrübenbau*, Year 23, No 14, pp. 165-167. Berlin, 1916.

In order to find an efficacious control of these beetles, the Author studied in detail the habits of the larva, and of the adult living on *Umbelliferae*. Contrary to any expectation the insects were found in numerous localities collected together on seeding sugar-beets. The species were those of *Agriotes lineatus* and *A. obscurus*, which were feeding on the pollen. One insect was seen to devour all the pollen of one flower in 10 minutes. The appearance of many of these insects on the seeding sugar-beet provided the opportunity of finding a method based on this fact to destroy the insect. For this purpose a bag was made of waxed cloth so that the interior surface would prevent the insects from climbing. To capture the insect by this means is very easy. The bag is placed below the inflorescence of the beet which is shaken, when the insects fall into the bag. The habit of the beetles in falling from the branches after a slight disturbance considerably helps the operation.

Two persons are needed for the work, one to hold the bag, the other to shake the plant. The work should be carried out in fine weather. In this way about 6 000 beetles were collected in a single day. The sugar-beets should be visited at intervals after flowering and capture should be commenced immediately the first insects appear. The operation should be repeated several times at the same places. The beetles sometimes reappear 3 hours after one removal, and then the operation should be repeated.

To apply this method, the seeding plants should be left in the beet-fields. According to the writer, in fields badly attacked by these insects, it is sufficient to have the seeding plants on small areas only.

- 112 - Diseases and Pests of the Sugar-beet observed in Austria-Hungary, during 1915. — FALLADA O., in *Osterreichisch-Ungarische Zeitschrift für Zuckerindustrie und Landwirtschaft*, Part 3, pp. 107-116. Vienna, 1916.

# I. ANIMAL PESTS.

*Elateridae*. — These voracious larvae, particularly those of *Agriotes lineatus* and *A. obscurus*, have caused great damage, especially in some

(1) See also B. November 1916, No 1245.

(Ed).

districts of central Bohemia. The soil being too wet at sowing-time, it later formed a superficial crust and consequently the beets grew slowly and were attacked by the larvae. In northern Bohemia the larvae were reported as injuring the young vegetation, but not more severely than usually; also in southern Moravia. In Silesia, Elaterids were found in large numbers in soil rich in humus; this pest has, however, not appeared in the Hungarian beet-fields.

*Melolontha* and *Rhizotrogus*. The larvae of *M. vulgaris* and *R. aequinoctialis* have appeared in the Sudeten region in smaller numbers than in previous years, as also in Hungary, where the damage caused was insignificant.

*Silpha* sp. — The larvae of this pest were not numerous, some of the species *S. reticulata* being found in southern Austria. In western Hungary Silphid larvae were reported at the end of May; the species was probably *S. atrata*, which had appeared there the year previously.

*Cleonus* sp. — caused little damage, even in those regions of Hungary that had been badly attacked in previous years.

*Haltica* sp. — This Coleopteron, together with the Elaters forms one of the worst enemies of the sugar beet, although it was only reported from 3 regions — central Bohemia, eastern Hungary, and southern Hungary. There, where it appeared at the same time as the Elaters, a second sowing had to be carried out in many cases.

*Agrotis segetum*. — The larva has caused serious damage to sugar beets in central Bohemia, and also in some districts of western and eastern Hungary. In the other regions of Austria-Hungary insignificant damage was caused.

*Lita* sp. — An isolated appearance of the larvae of *Lita* devouring beet leaves was recorded towards the end of July from eastern Hungary. Unfortunately it was not possible to study this little known Lepidopteron more thoroughly. It is probably *Lita atriplicella*, living on *Chenopodium* and *Atriplex*, an insect related to *Lita ocellatella* living on *Beta maritima*. The larva mines the leaves like the following insect.

*Anthomyia conformis*. — This insect is only recorded from one district of central Bohemia where it is wrongly known as green caterpillar ("Grünraupe").

*Aphis papaveris*. — This species caused some damage in western Hungary during the first half of June. Beets sown early resist the pest much better than those sown later. The insect was not reported from other regions of the empire.

Other sugar beet pests such as *Gryllotalpa vulgaris*, *Atomaria linearis*, *Cassida nebulosa*, *Tetranychus telarius*, *Julus* sp. as well as *Athalia spinarum* and *Tipula oleracea*, caused no damage last year.

## II. DISEASES.

*Root Gangrene*. — This disease only occurred in isolated cases. Fairly considerable damage was caused in central Bohemia, but the fine June weather made up for the loss. Attacked roots showed the presence



of *Phoma betae* which had probably been transmitted to the roots by the soil.

*Heart rot and dry rot.* — The above mentioned beets whose roots were attacked by *Phoma betae*, showed blackened heart-leaves at the same time (end of May) and as microscopic examination showed the presence of *Phoma* it was concluded that the heart leaves were also attacked. Heart-rot usually only appears at the end of July to the beginning of August. It was observed that the climate was probably unfavourable to the spread of the fungus, for attacked plants gradually recovered. In July, beets of tardy development as well as many of normal development showed attacked external leaves.

The edges of the leaves were less developed, while the colour had become paler, and the plants seemed to be suffering from nitrogen-starvation. The cause was probably of a physiological or nutritive character due to the disease attacking young plants. This seems to be confirmed by the freedom of the diseased leaves from parasites while the roots were also healthy. It is further observed that diseased roots that were big were heavier and with a greater sugar content than healthy-roots. The ratio  $\frac{\text{roots}}{\text{leaves}} = \frac{1}{1.3}$  shows a certain precocity in diseased beets which may also be a sign of lack of nitrogen.

Other diseases were not observed by the Author in 1915.

113 - **Injuries to Seed-producing Tea Plantations, in Java.** — BERNARD CH., in *Mededeelingen van het Proefstation voor Thee*, N° XXXIX, pp. 1-24, 3 Pl. Buitenzorg, 1915.

In the first chapter the Author translates the report of a voyage by Mr. A. S. TUNSTALL, in Cachar and Sylhet in order to study seed-producing tea-plantations.

Another chapter gives some observations made by the Author in Java.

A description is given of the renovation of a plantation intended for the production of seed, which, after producing normally for 25 years, hardly produced any normal seeds. As all remedies appeared useless, it was decided, after a few preliminary trials, to cut down the trees to a foot above the ground, after which new stalks appeared, 4 of which were retained for future development. In the same paper, a case is mentioned where a scale-insect belonging to the *Monophlebinae* was attacking the roots of the tea plant; the insect is particularly injurious to the rootlets.

It is advised, in order to avoid the damage that *Adrama determinata* (1) causes to the seed, to collect all the seed that has fallen to the ground. After sorting in water, they can be preserved in boxes out of the way of the parasite, if not required immediately for sowing.

114 - ***Metamasius ritchiei* n. sp., a Coleopteron Injurious to the Pineapple, in Jamaica.** — MARSHALL GUY A. K., in *Bulletin of Entomological Research*, Vol. V'I, Part 2, pp. 197-198, 1 fig. London, 1916.

Systematic description of *Metamasius ritchiei* n. sp. (sub-fam. *Calandrinae*). According to information supplied by Mr. A. H. RITCHIE, entomo-

(1) See B. August 1915; N° 877.

logist to the Government of Jamaica, these insects appeared in the Rocks district about four years ago, and their number has continually increased.

They principally damage the shoots that develop on the underground parts of the pineapple, and which finally form a root system independent of that of the mother plant ("ratoon pines").

The plants may be attacked in various points; the fruit is particularly chosen.

In 1916, the insect caused a loss of 75 per cent. of the crop.

Besides *M. ritchiei*, many specimens of *M. sericeus* Oliv. have been seen, but according to MR. RITCHIE, the presence of this second species is only of secondary importance in the present case.

115 - **On Species of Tripanidae (Diptera), Genus *Carpomyia* Injurious to the Fruits of *Zizyphus*.** — SILVESTRI F. in *Bollettino del Laboratorio di Zoologia generale e agraria della R. Scuola superiore d'Agricoltura in Portici*, Vol. XI, pp. 170-182, fig. I-IX. Portici, 1916.

The genus *Carpomyia* Rond. includes two species of very wide geographical distribution, one of which *C. vesuviana* A. Costa, occurs in Southern Italy, Dalmatia and Southern India and the other in Southern Italy, Egypt and Eritrea. These two species pass their larval stage in the fruits of certain species of *Zizyphus* viz: *Z. sativa* in Italy (*C. vesuviana* and *C. incompleta*), *Z. Jujuba* in India (*C. vesuviana*), *Z. Spinacristi* in Eritrea (*C. incompleta*).

In 1910 BEZZI undertook the systematic classification of the genus, briefly redescribing the two species. The present writer now describes the larvae of these species for the first time and gives a new description of the adults accompanied by figures and biological notes.

As natural enemies of *C. vesuviana* are noted: an ectophagous parasite of the larva, *Bracon fletcheri* Silv., and an endophagous parasite which emerges from the pupae, *Biosteres carpomyiae* Silv., both obtained in India by Th. B. Fletcher.

From *B. carpomyiae*, the writer has obtained, from the 20th to the 25th September, 5 specimens emerged from pupae of *Carpomyia* forwarded from India in February.

The writer has not succeeded in obtaining in Italy a single endophagous parasite of the larvae or pupae of *C. incompleta*, but only a few specimens of *Eupelmus urozonus*, a Chalcid ectophagous parasite of numerous other insects, among which *Dacus oleae*. From the pupae of *C. incompleta* collected at Cheren (Eritrea) in February 1914, a fair number of specimens of *Opius concolor* Szepf. were obtained, and, from a pupa, two females of a *Tetrastichus* slightly differing from the female of *T. giffardianus* Silv. While awaiting the identification of the male of this *Tetrastichus*, the author leaves the question of its determination open.

116 - ***Lecanium capreae*, a Scale Insect Injurious to *Robinia* Plantations, in the Province of Ekaterinoslav (Russia).** — КОЛЕСНИКОВЪ Александръ (KOLESNIKOV ALEXANDER), in *Сельское Хозяйство и Лесоводство (Agriculture and Sylviculture)*, Vol. CCLI, Year LXXXVI, pp. 104-205. Petrograd, 1916.

In describing the present state of the *Robinia* plantations in the Circle of Komisarovsk of the Forest Region of Verchnednieprovsk (province of

Ekaterinoslav), the author calls attention to a scale-insect recorded from 1908-1909 onwards on the young stems and branches of the *Robinia*, thus showing the error of the common idea that this plant was almost immune from insect attack. The parts attacked dry up from the tip downwards, so that the young plant dies. The most serious injury was found in 5-7 year-old plantations; the insect is rarely seen on plants over 10 years old. In places where the pest was very numerous, it was also recorded on *Eucalyptus europaeus*.

According to the identification by the Entomological Branch of the Forests Department, the pest is *Lecanium capreae*. Under the large shield of the female are found the eggs, from which the young emerge about mid-summer (July) and spread in all directions. Towards winter, the scale-insects fix themselves in previously chosen spots and commence development; they only attain full growth in April.

When the shield is formed, the female commences oviposition and by May has laid 2 000 eggs.

The female then dies, and the scale, remaining behind, serves to protect the eggs from injury.



INTERNATIONAL INSTITUTE OF AGRICULTURE  
BUREAU OF AGRICULTURAL INTELLIGENCE AND PLANT DISEASES

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FIRST PART.

ORIGINAL ARTICLES

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**The Organisation of the Agricultural Department  
in the Belgian Congo.**

BY

Baron F. FALLON

*Agricultural Engineer at the Belgian Colonial Office.*

There has been an agricultural department working in the Belgian Congo for some 15 years, but it was only 2 years after Belgium had retaken the Colony (1908) that the department was organised according to the principles holding in the large modern colonies.

M. T. RENKIN, Minister for the Colonies, confided the organisation to M. LEPLAE, Professor of Colonial Agriculture in the University of Louvain, who had studied the special conditions of colonial agriculture in several colonies in the tropics. At his request several members of the agricultural staff were sent to various foreign colonies in order to gain special experience: their chief stays were made in Ceylon, Java and Sumatra, Malaya, South Africa and British and German East Africa.

New laboratories and experimental centres were founded and fully equipped for the study of plant and animal diseases. The best of the existing experimental stations were developed. Finally, the general agricultural equipment was completed, chiefly by the despatch of steam cultivators and machines for the treatment of coffee, rice, cotton, fibres, etc.

A Publication was begun of a quarterly periodical known as the *Bulletin agricole du Congo belge*.

The agricultural programme distinctly favoured scientific and practical research.

After only 5 years' experience of this system it is already perfectly clear that all new progress must be along methodical and prudent lines and that as much useful information must be obtained as possible to serve as basis for that progress.

In a country as new as the Belgian Congo, it is obvious that, along with favourable factors, numerous difficulties and problems must arise, the solutions to which can only be obtained by investigations conducted in accordance with modern science progress.

#### RESEARCH LABORATORIES.

The Colony possesses at the present moment 5 laboratories well equipped for scientific research on any agricultural problems which may be submitted to them by the various colonies or which the Directors of the laboratories may consider of general interest.

Two *Laboratories of Agricultural Chemistry and Plant Physiology* are at work, one at Zambi (Lower Congo), the other at Elisabethville (Katanga). Their researches for many years past have been directed exclusively towards the study of the agricultural soils of the colony.

A *Laboratory of Agricultural Mycology* is attached to the Eala Botanical Garden. The Director is M. VERMOESEN, D. Sc. who was sent to the British and Dutch Indies in order to study the diseases of colonial plants and the modern scientific methods for their control.

The mycologist visits the State plantations and also, on request, those of private individuals where there is any outbreak of disease. He then prescribes such measures of control as seem advisable and may even make their adoption obligatory by means of bye-laws.

The first subject to receive attention has been the treatment of fungoid diseases of cacao and coffee. Other researches have also been made, particularly that on *Fomes semitostus*, a fungus distributed throughout equatorial countries and which attacks the roots of Hevea.

The *Laboratory of Agricultural Entomology* has hitherto been situated in the Eala Botanical Garden. The Director is Mr. MAYNE, who has carried out some very interesting work on insects attacking cacao, coffee and rubber plantations.

The results obtained by the departments of mycology and entomology are published regularly in the *Bulletin agricole du Congo belge* and in the *Etudes de Biologie agricole*.

The following works have been published :

*Sahlbergella singularis* (Hagl.) producing canker of cacao (*Bull. Agr.*, Vol. V, No. 2).

*Stephanoderes coffeae*, (Haged) injurious to coffee (*Bull. Agr.*, Vol. V, No. 4).

*Papilio demoleus* attacking species of *Citrus* (*Bull. Agr.*, Vol. V, No. 4).

The pests of *Hevea* (*Bull. Agr.*, Vol. V, No. 4).

On the Oviposition of *Sahlbergella singularis* (*Bull. Agr.*, Vol. VII, No. 1-2),

A *Laboratory of Veterinary Bacteriology* was attached in 1912 to the Stock Breeding Station at Zambi. The Director is M. NEEFS, veterinary surgeon in the Belgian Army, who completed his studies in the tropical laboratories of Nairobi (British East Africa) and Pretoria (Transvaal).

The Zambi Stock-breeding station offers exceptional facilities for the study of animal diseases. Every kind of domestic animal is kept and raised, forming important herds, including numerous varieties imported from various regions of the globe. Among these are horned cattle from Angola, Ceylon (Zebu), Dahomey, Belgium; horses from Senegal, Java, Russia and Belgium; asses from Sicily and other parts of Italy, Poitou and Senegal, etc. The Station is situated close to the important breeding centre of Matebbe (4000 head).

The chief efforts of the Bacteriological Laboratory have been devoted to the study of the diseases most frequently encountered in the Colony: trypanosomiasis, various skin diseases (mange, scab, etc.), pneumonia, piroplasmiasis, etc.

### EXPERIMENTAL STATIONS.

A. — FIELD CROPS — Preliminary experiments in cultivation in the wild countries of Central Africa invariably involve high expense and almost always distinct set backs. It is only rarely that the individual colonists and even the Agricultural Societies themselves possess the necessary resources to enable them to undertake such costly research without considerable danger. The Belgians owing to their total lack of experience of colonial agriculture, were particularly handicapped from this point of view. The experimental work was consequently undertaken by the State.

The primary object of the Experimental Stations of the Belgian Congo was to show the material possibility of various kinds of crops and branches of breeding. When this first result has been achieved it is absolutely necessary, from the practical point of view, to show that these particular undertakings are capable of yielding an adequate return and that they deserve the attention of agriculturists and of companies working plantations.

*Eala Botanical Garden.* — The Eala establishment, comprising a botanical and an experimental garden was founded in 1890, on the banks of the Kuki river exactly on the Equator, where it was placed on the advice of Prof. EMILE LAURENT. Situated in a warm region with regular rainfall, the Eala Botanical Garden is particularly well adapted to the study and propagation of equatorial plants. It now contains a great number of species and varieties of which 600 are indigenous to the Congo and forms a scientific centre of acknowledged reputation.

The Experimental Garden contains about 200 plots devoted to economic and ornamental plants.

The fact that the laboratories of mycology and entomology belonging to the colony are also situated at Eala has already been noted.

An apartment with work-room attached is reserved for foreign botanists who intend working on the flora of Central Africa.

*Experimental Farm of Munama (Katanga).* Experiments of great interest are carried out on this farm with the view of establishing practical



methods for the conservation of the fertility of Katanga soils, and also for showing the farming colonists established in the mining region the means of increasing the returns from the cultivation of the best paying kinds of crops. The experiments are also directed to the improvement of soils by means of chemical manures and irrigation.

The results obtained at Munama, under the direction of M. ROMMELAERE, have already considerably aided the solution of the big farming problems set by the nature of the Katanga soils and by the presence of the tsetse fly, which renders the use of draught animals impossible for initial clearing and for the first few years' work of cultivation.

Irrigation, green manuring, the keeping of cattle permanently stabled and the use of wood ash have already been instrumental in securing bumper crops. At the present moment the Station is studying the question of lowering the cost of production by the use of machines.

The remaining Stations have specialised as much as possible in research and experimental work on a single class of crop or on a single class of breeding. An account of these is given below.

*Cacao.* — Numerous plantations of cacao had been established in the equatorial zone by the independent State, but since the work of reorganisation, experiments on the cultivation of this crop are carried on only at the Station of Barumbu (Aruwimi). This plantation is nearly 20 years old but it had been badly looked after and rapidly deteriorated when the new Department of Agriculture took it over in 1911. It then contained 75 000 plants of cacao, 35 000 of which were in too poor a state to survive. The remaining 35000, however, soon repaid the work of careful cultivation and once the plantations had been put on a sound footing they developed vigorously. The plantation is now a splendid one and gives a profit estimated at one million francs.

Experiments have proved that the cultivation of cacao, with proper management, is very remunerative in the region of the Upper Congo, the central region being perfectly adapted to this crop.

Barumbu cacao sells on the London market at very high prices which the Agricultural Department hopes to see still further increased as a result of improvements in the method of preparation.

*Coffee.* — The principal Experimental Station in connection with the cultivation of coffee is situated at Luda, about 5 miles from Stanleyville along the Great African Lakes Railway.

Attention is chiefly given to selection of suitable varieties, to the yield, and to the different methods of preparation of the product.

The Luda Station includes 200 acres of coffee plantations composed of several varieties, one half of which is now in full bearing.

The production of marketable coffee exceeds 8 cwt. per acre. In 1915 the production was 43 tons and in 1916 some 55 tons. Experts pronounce this coffee to be excellent.

*Rubber.* — Forest rubber, *i. e.* collected from the lianes and wild trees of the forests, was for a long time the only kind exported from the Belgian Congo. Until quite recently the production of plantation rubber was in-

significant and it was only when the State experimental plantations first matured *i. e.* in 1914, that this product appeared on the European market.

The cultivation of *Hevea brasiliensis*, begun at Bakusu (Equator) in 1904, has given encouraging results. It was only in 1910, however, after the reorganisation of the Department of Agriculture, that this crop was extended. Besides Bakusu there are now 10 other stations devoting their chief attention to rubber.

Experiments have shown that *Hevea* thrives well in the Congo, provided attention has been paid to securing the proper soil and climatic conditions.

Bakusu rubber has reached very satisfactory prices on the European markets and experts consider it to be of very good quality.

The cultivation of *Funtumia elastica* or "Ireh" a native tree, was undertaken as early as 1901, but active attention was only first paid to its propagation in 1906.

The yield of this rubber tree is too low to justify pure plantations of *Funtumia*, but it seems capable of being turned to an interesting purpose: in 1912, in order to increase the yield per acre, the Department planted coffee and cacao among certain plantations of *Funtumia*. The result given by the planting of cacao seems particularly interesting, as the shade provided by the rubber-producing species appears to combine all the qualities required for encouraging the successful growth of the cacao.

*Manihot Glaziovii*, or Ceara rubber tree, has been tried for a number of years in various parts of the Colony. The State possesses a very fine plantation, possibly one of the best in the whole of Africa, at the Station of Bokala (Middle-Congo).

*Fibre plants.* — Various kinds of *Agave* and *Fourcroya* are cultivated on the majority of agricultural stations in the colony. The largest plantations are at Congo da Lemba (Lower Congo).

Three varieties of Sisal have been tested so far: *Agave rigida*, var. *sisalana*, *Agave santula* and *Agave tequilana* (Weber or Azul).

Important experiments are now in progress with Sisal on the Lower Congo where climate and soil appear very favourable.

The *cotton plant* does admirably in the Belgian Congo. Those introduced at various unknown times by the Arabs and Portuguese are found throughout the Colony but are nowhere the object of regular cultivation. Some effort had been made previous to 1908 by the natives of the Lower Congo, but the results were nil. In 1911, it was resolved to have recourse to more scientific methods and the Government, through the agency of the "British Cotton-Growing Association", engaged an American scientist, Mr. FISHER, who for several years had been in charge of the cotton plantations on the Gold Coast. This specialist was given the task of conducting trials in cotton growing throughout the various districts of the colony in turn in which the climate, soil and population appeared to be most suitable. He made a start in the Lower Congo and later introduced the plant in the district of Mamenia to the south of Stanleyville.

The results obtained were very satisfactory: the cotton was quoted



at a very high price at Liverpool, and the yield per acre was at least as high as in the remainder of the African Colonies.

The cotton-growing Station of Nyangwe continues its work, and Mr. FISHER has now been sent to the thickly-populated region of Kasai in order to introduce cotton growing in that part also.

*B. STOCK-BREEDING. — Zambé Zootechnical Station.* — This Station is chiefly concerned with acclimatisation trials with European and Asiatic breeds, and with crossing them with the indigenous breeds.

Mule breeding is conducted with the help of Belgian or Senegalese mares and asses from Poitou, Sicily and other parts of Italy.

Situated on the river bank in the midst of a wide grassy plain, close to Boma, the capital of the Congo, the Zambé establishment is splendidly adapted to the object in view.

The Laboratory of Veterinary Bacteriology is attached to this Station and so finds on the spot many of the elements necessary for its research.

*Station of Katentania (Katanga).* — Situated on the Bianos high plateaux, a region of immense pastures, this Station forms at present the largest centre for cattle breeding in the Colony. The herds, which, with the exception of a few half-bred bulls (Hereford and Devon), are composed entirely of animals of the Barotse and Mashakalumbe races, number nearly 2000 head, and pasture over some 124 000 acres of prairie and wooded savannah. A flock of Persian sheep has just been introduced (1916).

The task of this Station is to demonstrate the possibility of raising cattle and sheep on the Katanga high plateaux, to improve the natural pastures and, by means of selection, to raise animals adapted to the local conditions.

*Nyangwe Stock Farm.* — The Nyangwe Stock Farm, along the Lua-laba river, is concerned with the development of stock-farming in the interesting region of Maniema. The natural conditions are favourable and the population, containing a large Arab element, is very intelligent.

The farm carries a herd of 500 cattle (including 70 draught oxen) and 50 horses.

*Kivie breeding centre.* — The district of Kivie, situated on the eastern frontier of the Belgian Congo, is one of the finest stock raising regions in the Colony. It carries numerous herds of native cattle, containing sometimes as many as 500 head.

The Department of Agriculture has sent several of its officers to this part in order to study and promote breeding in a region which undoubtedly has a future.

*Centre for the taming and training of elephants at Api (Uele).* — In 1899 the Congo Free State undertook methodical work in capturing and training elephants. At the head of this work was Commandant LAPLUME who made the Camp of Api his head quarters.

At the present time the Colony possesses 35 elephants, young and mature animals, which are the object of progressive and methodical trai-



ning. Splendid results have been obtained with these beasts. It has been definitely proved that the African elephant is no whit behind its Asiatic relative in the matter of capacity for training.

#### DEVELOPMENT OF EUROPEAN COLONISATION.

The Belgian Congo is essentially what one may term a colony for "colonisation", that is to say its riches can only be fully utilised by white colonists: individuals or financial concerns, agriculturists, traders or manufacturers.

The Equatorial Congo, owing to the moist and hot climate, is obviously less adapted to colonisation by Europeans than the higher regions with more temperate climate, situated to the East and West; nevertheless it is none the less capable of colonisation.

An attempt at colonisation has been begun in the Central Congo, at Kunzulu (Middle Congo), with the object of establishing, in the tropical zones of Africa, a European population. Although the results cannot yet be said to be complete, they have nevertheless shown that whites are perfectly capable of living and working in these regions. The attempts will be continued for number of years to come.

Katanga, owing to its healthy climate and numerous population employed in the copper mines, has long since attracted the attention of the Government which proposed to establish a European farming colony in that region.

The attempt at colonisation made in 1911 in the neighbourhood of Elizabethville with the idea of establishing a number of small proprietors, has passed through some very difficult times, but it must be admitted that the farmers installed at Katanga have made real progress of recent years. They have become true colonials with a great attachment to their farms.

Around Elizabethville and Kambove there are some forty properties and the value of the harvests obtained by these small farms has already reached a respectable figure.

Larger farms, of 740 to 2500 acres and more, are in course of preparation.

While the small holdings are specially concerned with market gardening, the larger farms are devoted to raising maize.

The district of Ituri, and particularly the neighbouring region of Kilo, also deserve attention both on account of the quality of the soil and of the excellent climate. It is particularly adapted to European colonisation and a number of white farmers have obtained very encouraging results.

#### DEVELOPMENT OF NATIVE AGRICULTURE.

In 1914 a resolve was made to set on foot a special organisation in order to develop native agriculture along systematic lines and to introduce into the villages crops capable of being exported.

The programme will be based on the cooperation of the territorial and agricultural departments. With this view the latter will appoint one or more agricultural scientists for each district where it is intended to start the propaganda.

The territorial authority, represented by the Commissioner of the District who is responsible for native affairs, will set to work on the population by persuasion and by explaining to them the advantages they will derive from the adoption of new crops or from the development of the old.

Next, the district agricultural officer will deal with the technical side of the question, will visit the villages, instruct the natives as to the new crops best suited to their district, inspect plantations and harvests, explain the precautions to be taken in order to obtain an abundant and high quality product and will show the profit resulting from its sale.

The district agricultural officer is undoubtedly the person indicated and indeed used for the purpose of controlling the sale of the products. In case of necessity, where dealers refrain from buying or tender inferior prices, he will procure the whole of the harvest for the State.

The propaganda will be carried out on a definite and precise plan and after an exhaustive study of the natural and economic conditions of the region.

In order to obtain large and regular exports such as it is wished to establish in the Congo, account must be taken of the methods of transport, of the aptitudes of the various native tribes and of the amount of care they are capable of exercising in the preparation of the products, in order to obtain satisfactory quotations on the European markets.

The results of the preliminary efforts of this organisation may already be seen: the growing of cotton by natives has developed in a number of districts; elsewhere it is that of rice, *Elaeis*, ground-nut etc.

In some districts an impetus has been given to stock-raising and breeding animals have been distributed among the most intelligent chiefs.

#### PUBLICATIONS OF THE DEPARTMENT OF AGRICULTURE.

1) Since 1910 the central administration has published an illustrated quarterly journal, the *Bulletin agricole du Congo belge*,

Other publications of the Department are:

2) *Mémoires scientifiques*, the 1<sup>st</sup> number of which is entitled: *L'appareil laticifère des caoutchoutiers* and is by Prof. A. MEUNIER D. Sc.

3) *Studies in Agricultural Biology*, 2 numbers of which have already appeared, viz:

Notes on *Glossinae* or tsetse flies, by E. HEGH, agricultural scientist on the staff of the Colonial Office;

*The Ticks of the Belgian Congo and the Diseases transmitted thereby*, by Prof. NUTTALL of Cambridge University.

Other works are in preparation, viz:

*Study of African Termites*, by E. HEGH, cited above.

*The Coccidae*, by Prof. NEWSTEAD of the Liverpool School of Tropical Medicine.

4) Various *Practical Notes* for agricultural colonists.

#### AGRICULTURAL ESTIMATES.

The Estimates of the Department of Agriculture for the year 1917 contain the following items:

1) Salaries of Colonial European Staff . . . . .	854 700 fr.
2) Salaries and upkeep of Native Staff . . . . .	381 770
3) Equipment of Agricultural Stations: purchase of cattle, material, etc. . . . .	152 670

Total . . . . . 1 389 140 fr.



## SECOND PART. ABSTRACTS

### AGRICULTURAL INTELLIGENCE

#### GENERAL INFORMATION.

DEVELOPMENT  
OF  
AGRICULTURE  
IN DIFFERENT  
COUNTRIES

117 - **Agricultural Development of the Province of Ontario, Canada.** — BERT ROADHOUSE W. — Deputy Minister of Agriculture, in *The Agricultural Gazette of Canada*, Vol. III, No. 9, pp. 799-806. Ottawa, September, 1916.

A very large amount of the Province of Ontario, probably over 30 million acres, is covered by great lakes and some of the larger timber reserves.

The section of the Province which is usually referred to as Ontario, and which includes a great part of the population, represents about 25 million assessed acres of which about 15 million acres are cleared. There is in addition the vast region known as New Ontario, which includes the clay belt, which alone is estimated to contain 20 million acres. This is now being opened up and there is no doubt but what there are agricultural possibilities as yet untouched far greater than what have so far been developed. The evolution of the Province through different stages of development, from the first settlements along the lakes and rivers, to the gradual pushing farther back of forests, is represented today by nearly 200 000 splendid farms, reached by 55 000 miles of rural highways, served by 3000 miles of steam railways and about 500 miles of electric railways and equipped with approximately 85 000 rural telephones. To this scene of rural Ontario, with the farmers of to-day speeding in their automobiles over the 55 000 miles of highways, must be added the scores of prosperous and progressive towns, and cities which are dotted every few miles and play their part in serving the rural communities. The rural population in the last census was 1 295 323 against 818 999 urban. The evolution in farming has been characterized in the last 25 years by an increase in the acreage of oats, maize, and hay and a decrease in the acreage of spring wheat, barley and winter wheat.

The following figures as to acreages in 1890 and 1914 may be of interest :

	W. Wheat	S. Wheat	Barley	Oats	Corn	Hay and Clover
Acres						
1890. . .	720 101	601 753	701 326	1 882 366	223 836	2 462 002
1914. . .	685 692	118 607	579 473	2 776 883	708 922	3 415 484

The increase in live stock in the same period was :

	1890	1915
Horses . . . . .	659 636	779 131
Milch Cows . . . . .	777 838	1 022 518
Other Cattle . . . . .	1 116 874	1 652 228
Swine . . . . .	1 140 559	1 769 295
Sheep . . . . .	1 339 695	908 095
Poultry . . . . .	6 854 864	14 273 091

Practically all parts of what is known as Old Ontario are now engaged in mixed farming with most farms having some line on which they specialize. Dairying is adopted very generally in Eastern Ontario where there are nearly nine hundred cheese factories, and in Western Ontario, where there are a large number of creameries and a few cheese factories. In the more northerly counties, districts are devoted more generally to beef cattle, but herds of beef cattle and swine may be found in every county. There is now in the province a fruit industry which represents possibly twenty million dollars annually, and a vegetable industry which aggregates several million dollars. Fruit growing has flourished in Ontario and 75 % of all the fruit in the Dominion is grown in this province. This includes 99 % of the peaches and 60 % of the plums, 70 % of the apples and 80 % of pears and small fruits. The peach-growing areas are located for the most part in the Niagara district skirting lake Ontario as far west as Niagara, but new and promising districts are now being developed in Norfolk, Essex and Lambton counties. The Niagara district is also the large vineyard of the province but plums and apples are grown in most sections. The special apple sections, however, are in Western Ontario, especially along Lake Erie and Lake Huron and north as far as Georgian Bay and in eastern Ontario along Lake Ontario and the St. Lawrence, including in the latter Dundas county which is the native home of the famous McIntosh Red apple. Altogether 306 767 acres are devoted to orchards. 24 360 to small fruits and 11 136 to vineyards. The products are marketed in the provinces in the West and to some extent in the export markets of Great Britain.

Ontario's annual returns from her fields aggregate in a good year over 200 million dollars. To this should be added possibly over another one hundred million from her live stock products. The following figures show the contrast in 25 years development in connection with the farm lands, buildings, implements and live stock in this province.

	Farm Land	Buildings	Implements	Live Stock	Total Farm Property
Value					
1890. . .	622 886 000	193 438 826	50 515 583	104 086 626	970 927 035
1914. . .	790 538 706	347 348 643	91 703 876	250 870 078	1 480 461 303

In connection with this development the work of the Ontario Department of Agriculture has had an important phase as a guiding factor.

Ontario, because of the diversity of the agriculture of the province, as above outlined, has many problems to face which are not in evidence in other provinces, but there is every reason to believe that these problems will be solved to the advantage of the people as a whole.

118- Recent Researches of the Imperial Institute on: Fibres from the Belgian Congo: the Pineapple as Fruit and Fibre Producer; Ceara Rubber from *Manihot Glaziovii* in Nigeria; the Essential Oil from the Tubers of *Kaempferia Ethelae*; The Essential Oil of *Cymbopogon flexuosus*. — *Bulletin of the Imperial Institute*, Vol. XIV, No. 3, pp. 378-388; 437-460. London, July-September, 1916.

FIBRES FROM THE BELGIAN CONGO. — The Imperial Institute of London has given all facilities to the Belgian authorities for dealing with the products of the Belgian Congo, and they have accordingly examined the bark of the baobab tree (*Adansonia digitata*); punga bark (*Cephalonema polyandrum*, a bush, 12 ft. high, found in the Belgian Congo and the Cameroons); several *Agave* and *Furcraea* fibres; and cord and rope made from the various fibres.

Both the baobab and punga barks could be suitable for paper-making.

The former is in favour in the United Kingdom for the production of wrapping papers with a high finish, and properly prepared material, *i.e.* with the outer bark removed, would fetch about £ 8 per ton in the United Kingdom under normal conditions.

The results of the examination of the fibres is given in Table I.

TABLE I. — *Analysis and estimation of Agave and Furcraea fibres from the Belgian Congo.*

	Percentage composition						Length	Value (1) per ton
	Moisture	Ash	$\alpha$ Hydro- lysis, loss	$\beta$ Hydro- lysis, loss	Acid purifica- tion, loss	Cellulose		
<i>A. rigida</i> var. <i>sisalana</i> . .	8.6%	1.2%	12.9%	14.6%	3.6%	77.3%	4 ft	£ 50
<i>A. Cantula</i> .	8.8	1.4	15.4	15.5	3.5	75.0	3-4 ft	£ 53
<i>A. Azul</i> . .	9.2	1.4	14.0	17.3	3.4	74.7	4-5 ft	£ 45-46
<i>F. Gigantea</i> .	0.4	1.8	17.1	18.5	5.4	74.2	5 ft	£ 45-46
<i>F. Lindeni</i> .	9.3	1.4	13.5	15.1	2.5	77.1	4½ ft	£ 44

(1) Valued at London with « fair » Manila hemp at £ 53 per ton (April 1916).

THE PINEAPPLE AS A FRUIT AND FIBRE PRODUCER. — This paper considers the botanical characters of the plant and its principal varieties — climatic conditions and soil requirements — the preparation of the soil,



propagation and planting, after-cultivation, manuring, harvesting yield (8000 to 15 000 fruits per acre in the West Indies, in Porto Rico from 10 to 14 tons per acre, in the Straits Settlements the yield is only about 5 000 fruits per acre; in Queensland up to 12 000 fruits per acre or over 13 tons of fruit per acre) — grading and packing — insect pests and fungoid diseases — tinning or canning pine-apples — pineapple fibre — pineapple cultivation in the British Empire.

The principal supplies of fresh fruit that reach the markets of the United Kingdom are derived from the Azores (in 1914 the latter exported 17500 cases worth £ 66 444). The tinned pineapple is imported chiefly from Singapore; in 1915, 305 709 cwt. worth £ 401 732 were imported into Great Britain. In the British Empire, the pineapple is cultivated; in many parts of India (Malabar coast), Burma, Khasi hills (Assam), Ceylon, Mauritius (in these two islands, the pineapple does well, but is only grown on a small scale) — Straits Settlements, where it forms an important industry, in which the cultivation and tinning are mainly carried out by Chinese, while the Europeans export the finished product (in 1914 Singapore exported 695436 cases of pineapples worth £ 305 383 of which 514 530 cases were sent to the United Kingdom) — Hong Kong New Territory — in Queensland (in 1914, the crop occupied 2584 acres producing 679 646 dozen fruits valued at £ 67 965) — in New South Wales — in the Northern Territory of Australia — in South Africa (Cape Province, Natal, Transvaal) — in British East Africa — Gold Coast — in the Southern Provinces of Nigeria — in the British West Indies, where this crop has declined owing to competition by Porto Rico and Cuba. Outside the British Empire the largest producer of tinned pineapples is Hawaii, where in 1913 the export was 1 600 000 cases, that is, about equal to the annual export of fresh fruit from Florida, Cuba, and Porto Rico together. The cultivation can be greatly increased or introduced in many countries; it is especially suitable as an intercrop with citrus fruits. In Porto Rico this combination is said to give satisfactory results.

Pineapple fibre is produced in fairly large quantities on the island of Hainan, South China, and on the Liu-Chow Peninsula on the mainland opposite. It is also produced on a smaller scale in Formosa, Hawaii and the Philippine Islands. In the latter, the fibre is made into fine fabrics known as piña cloth. For fibre production the plants are grown closer together than when fruit only is required in order to induce the formation of long leaves; or they may be grown under trees in partial shade.

The preparation of the fibre involves very tedious manual labour, as the machine product is not of such good quality, which is a serious obstacle to the spread of the industry. In Hainan the leaves may be gathered the first year, but it is more usual to wait till the second year, as better quality is obtained. About 12 leaves are taken from each plant, each leaf then being scraped on both sides to remove the green tissues. The fibres are then alternately macerated in cold water for 6 hours, then dried in the sun, for several times lasting about 3 days. In the Philippines, each layer of fibres is removed as it is exposed by the scraping; 50 to 60 lb. of

fibre is obtained per ton of green leaves, which is very low considering the amount of labour involved. The combings from pineapple fibre are said to give excellent results for paper making.

CEARA RUBBER FROM *Manihot Glaziovii* IN NIGERIA. — 2 samples of rubber were examined from the Government plantation at Ankpa, Bassa (Northern Provinces) and obtained respectively in 1915 from 3 year old trees, and in 1916, from 4 year old trees. The physical properties were determined on the second sample, the results being given in Tables II and III.

TABLE II. — *Analysis and valuation of samples of rubber from Manihot Glaziovii in Nigeria.*

Samples	Loss on washing (moisture and impurities)	Percentage Composition of Dried and Washed Rubber				Value per lb. at London
		Rubber	Resin	Protein	Ash	
1915. . . . .	5.3%	83.1%	5.3%	9.9%	1.7%	2s. - 2s. 1d. (1)
1916. . . . .	8.0	84.7	6.3	7.7	1.3	2s. 4d. - 2s. 6d. (2)

(1) With fine hard Para at 2s. 6<sup>3</sup>/<sub>4</sub>d. per lb.

(2) April 1916.

TABLE III. — *Physical properties of the vulcanised rubber.*

	Time of Cure minutes at 50 lb. pressure	Tensile strength lbs. per sq. in.	Elongation Per cent.
	—	—	—
Present Sample . . . . .	50	2 330	847
Plantation Para Sheet (average figures)	70	2 300-2 400	875

THE ESSENTIAL OIL FROM SHERUNGULU TUBERS (*Kaempferia Ethelae*). — The Table IV summarises the results of the recent examination of a sample and also of another sample examined previously (*Bulletin of the Imperial Institute*, Vol. XIII, 15, 1915). It will not be profitable to distill the tubers for the production of oil as the oil does not possess a desirable odour or a sufficient amount of any constituent which is particularly useful from a perfumery point of view. Both essence extraction and distillation processes failed to yield a valuable oil. The reason is that, although the oil contains methyl anthranilate, both valuable perfumes, these are only present in small amount, and their odour is masked by the unpleasant smell of other constituents like cineol and the solid ketone. Further, the high boiling constituents of the oil are of a comparatively odourless type, and consequently the oil, considered as a perfume, lacks persistence.

TABLE IV. — *Results of examining the essential oil obtained by distilling.*

	Sample examined in 1916	Sample examined in 1915
Yield of volatile oil, expressed on the tubers as received	2.35	1.9
Specific gravity at 15° C . . . . .	0.924	0.944
Optical rotation in a 100 mm. tube at 22° C. . . . .	64.2	19.477
Acid Value . . . . .	1.0	2.3
Ester value before acetylation . . . . .	11.5	5
Ester value after acetylation . . . . .	33.6	47.6
<i>Fractional Distillation</i>		
Fraction distilling at 160°-195° C. . . . .	44	42
Fraction distilling at 195°-270° C. . . . .	26	25
Residue (Chiefly ketone and sesquiterpene) . . . . .	30	33

THE ESSENTIAL OIL OF LEMON GRASS (*Cymbopogon flexuosus*) FROM INDIA. — The plant was identified at Kew as *C. flexuosus* Stapf. f. *albescens*. The oil obtained from this plant had the usual odour, was cloudy and of reddish-brown colour. The oil was too dark to find its optical rotation.

TABLE V. — *Shows its main characteristics.*

Specific gravity at 15° C. . . . .	0.915 %
Aldehydes, per cent. . . . .	81.0 %
Solubility :	
in 80 % alcohol . . . . .	Soluble in 0.7 or more vols. becoming slightly turbid in 4.5 vols.
in 70 % alcohol . . . . .	Not soluble in 5 vols, at 15° C., but soluble in 2.5 vols at 20° C.

From the fact that this sample of oil, prepared from authentic material, is of an "insoluble" type, it seems clear that the occasional "insolubility" of Cochin lemon grass oil is not due to chance inclusion with the typical lemon grass (*C. flexuosus*) of other wild grasses yielding an "insoluble" oil; the "insolubility" is probably due to the distillation being carried too far, so that "insoluble" constituents "are included in the distillate.

## CROPS AND CULTIVATION.

119 - **Experiments on Loss of Moisture from Soils by Evaporation (Dry Farming).** — DE ANGELIS D'OSSAT G., in *Le Stazioni Sperimentali Agrarie Italiane*, Vol. XLIX, No. 11, pp. 563-582, 4 tables, 7 fig. Modena, 1916 (Abstract by Author).

There occur not only in the Italian colonies, but also in Italy itself (especially in Sicily and Sardinia and in the southern portion of the peninsula) years of low rainfall comparable with and even drier than those regularly experienced in the semi-arid zones. In such cases therefore it is essential that the rules applying to "dry-farming" should be followed.

In this connection the writer has carried out laboratory researches for the last 3 years on evaporation of moisture from sands, clays and loams. The liquid employed was distilled water and, in order to allow for varia-



tions due to the density of the liquid in circulation, use was also made of distilled water saturated with gypsum.

The soils have been thoroughly investigated as to their lithological, physical and mechanical characters and properties. The *colloidal clay* has also been separated and weighed, according to KONIG's method. The author gives a table showing in detail all the variations in the weights of soils, observed during June and July 1916, in relation to maximum and minimum temperatures and absolute and relative humidity.

*Weights (in grams) and volumes (%) of water evaporated during the ascending phase (from 4th to 19th June, 1916).*

Nos. of pots	Soil	Weight of water evaporated in grams	Differences	Volume of water evaporated	Differences
Distilled water :					
1	Sand . . . . .	109.0 gr.	53.6 gr.	72.66 %	35.73 %
2	Sand . . . . .	55.4 gr.		39.93 %	
3	Sand $\frac{2}{3}$ + Clay $\frac{1}{3}$ . .	105.0 gr.	35.8 gr.	70.00 %	23.87 %
4	Sand $\frac{2}{3}$ + Clay $\frac{1}{3}$ . .	69.2 gr.		46.13 %	
5	Sand $\frac{1}{3}$ + Clay $\frac{2}{3}$ . .	98.4 gr.	31.2 gr.	65.60 %	20.80 %
6	Sand $\frac{1}{3}$ + Clay $\frac{2}{3}$ . .	67.2 gr.		44.80 %	
7	Clay. . . . .	70.2 gr.	17.2 gr.	46.80 %	11.47 %
8	Clay . . . . .	53.0 gr.		35.33 %	
Distilled water saturated with Gypsum :					
9	Sand . . . . .	106.8 gr.	38.3 gr.	71.20 %	25.54 %
10	Sand . . . . .	68.5 gr.		45.66 %	
11	Clay . . . . .	87.2 gr.	27.4 gr.	58.13 %	18.27 %
12	Clay . . . . .	59.8 gr.		39.86 %	

In the above table, which gives the evaporation data obtained from the 4th to the 19th of June, the odd numbers indicate the pots in which the soil surface remained packed during the period covered by the observations, while the even numbers refer to the soils the surfaces of which had been loosened.

The results as recorded in this table enable the following conclusions to be drawn :

1) During the period from the 4th to the 19th June, the *definitely sandy* soils with loosened surface retained 35.73 % more water (in volume) than the soils of similar nature with packed surface.

2) In the same conditions, the *clay* soils with loosened surface retained 11.47 % more water than those with packed surface.

3) In soils composed of : sand  $\frac{2}{3}$ , clay  $\frac{1}{3}$ , the increase in the proportion of humidity retained due to the loosening of the surface was 23.87 %.

4) In soils composed of : sand  $\frac{1}{3}$ , clay  $\frac{2}{3}$ , this increase was 20.80 %.

5) In soils, in which the water was saturated with gypsum, advantages were observed analogous to those obtained by loosening the surface layer, but the differences between sand and clay were less noticeable.

The percentage volumes of water remaining in the sand and in the clay after the period of evaporation were :

Sand		Clay	
with packed surface layer	with loose surface layer	with packed surface layer	with loose surface layer
27.34 %	63.07 %	53.20 %	64.67 %

In relating the differences found in pots Nos 1 and 2 to natural conditions and supposing the moisture capacity of the soil to be at its maximum (40 %) at the beginning of the experiment, it is seen that :

*The difference in evaporation exceeds in amount a layer of water 14 cm. thick, that is to say that the soil with loose surface layer retains per hectare (1 hect. = 2.4711 acres) at least 1 400 cubic meters more water than the soil with compact surface layer.*

The writer recommends further experiments of this type under natural conditions as varied as possible with regard to character of soil, position, altitude, type of crop, etc., especially in Central and Southern Italy.

#### 120 - Stimulating Influence of Arsenic upon the Nitrogen-Fixing Organisms of the Soil.

— GREAVES J. E., (Bacteriologist, Utah Agricultural Experiment Station) in *Journal of Agricultural Research*, Vol. VI., No. 11, pp. 380-426 + fig. 1-5. Washington D. C. June 12, 1916.

In the course of previous experiments, the writer found that the addition of arsenic to the soil stimulates the ammonifying, and especially the nitrifying microorganisms. The stimulation varied greatly with the form, quantity, and method of applying the arsenic. Further, it was found that very large quantities of arsenic had to be applied to a soil before its toxic effect became marked. This toxic effect became pronounced only when quantities of arsenic which far exceeded those found in any of the cultivated soils had been applied. Therefore it was desirable to determine the influence and mode of action of arsenic upon the nitrogen-fixing powers of the soil. For this purpose the writer made cultures in a sandy loam to which mannite was added as well as the various arsenical compounds, in solution and in the dry state, which were used in the experiment. After

incubation, the total nitrogen was determined. The arsenical compounds used were: sodium arsenate, lead arsenate, cupric aceto-arsenite (Paris Green), arsenic trisulphide and zinc arsenite in the serial proportions of 0 to 400 p. p. m.

The data thus obtained, and the results given by similar experiments carried out by other writers, prove conclusively that arsenic, when added to the soil in the forms of sodium arsenate, lead arsenate, or of arsenic trisulphide and zinc arsenite, stimulates the nitrogen-fixing powers of the soil. This stimulation is greatest when lead arsenate is applied and least when zinc arsenite is used. Paris green did not stimulate in any of the concentrations and became very toxic when the concentration reached 120 p. p. m. The toxicity of this compound is due to the copper, and not to the arsenic contained in it. Sodium arsenate became toxic when a concentration of 40 p. p. m. of arsenic was added, and 250 p. p. m. of arsenic entirely stopped nitrogen fixation. On the other hand, lead arsenate was not toxic, even at a concentration of 400 p. p. m. of arsenic, while the toxicity of arsenic trisulphide and of zinc arsenite was very small at this concentration.

The stimulating effect of arsenic is not due to any inherent peculiarity of the soil used, for soils which vary greatly in physical and chemical properties had their nitrogen-fixing powers greatly increased when arsenic was applied to them. Soils high in organic matter fixed as much nitrogen, in the presence of arsenic and in the absence of mannite, than they did in the absence of arsenic and the presence of mannite. The stimulation is greatest when the water-soluble arsenic content is about 10 p. p. m. and as this quantity exceeds that found in most soils, it is probable that in agricultural practice, arsenic will stimulate and not retard bacterial activity in the soil.

Only one type of *Azotobacter* was isolated which was stimulated by arsenic, and in this case the stimulation was due to the organism utilising its source of carbon more economically in the presence of arsenic than in the absence of arsenic. Thus arsenic and its compounds do not act as sources of energy to the organisms. The main part of the stimulation noted in the soil with its mixed flora is undoubtedly due to the arsenic inhibiting injurious species.

A given quantity of arsenic which act as a stimulant to bacteria when placed in soil may become very toxic when tested by the Remy — solution method (1).

Arsenic cannot replace phosphorus in the vital process of the nitrogen-fixing organisms, but it can in some manner liberate the phosphorus from its insoluble compounds. This may be either a direct, or an indirect, action.

The cellulose ferments are stimulated by arsenic, and in their turn, react upon the activity of the nitrogen-fixing organisms.

The nitrogen-fixing powers of soil extract, of filtered soil extract and

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(1) An inoculated and incubated nutritive solution containing. bi-potassic phosphate 0.2 per 1000 - magnesium sulphate 0.2 per 1000 - calcium chloride 0.2 per 1000 - calcium carbonate 10 per 1000 - ferric chloride 1 drop of solution containing 10 % per litre. (Ed.)



soil dried for some time are only slightly stimulated by arsenic, which shows that arsenic acts mainly by the removal of a thermolabile body occurring in the soil.

In the appendix is a bibliography of the 45 publications mentioned in the text of the article.

**121 - On the Classification of Soils according to the Electrical Conductivity of their Aqueous Extract.** — VON HOWATH B., in *Internationale Mitteilungen für Bodenkunde*, Vol. 6, Part 4, pp. 230-236. Berlin, 1916.

The writer has experimented with a view to finding if the electrical conductivity of a aqueous extract from soil could furnish a criterion for the classification of soils. The extract was made with carefully distilled water having an electrical conductivity  $\alpha + 10^6 = 3.35$  at  $18^\circ\text{C}$  by the GEDROIC method used by the Bureau of Soils of the United States. 50 grms of soil were put in a beaker and washed with 250 cc. of distilled water; it was stirred with a glass rod for 3 minutes; then after filtering, the filtrate was tested to ascertain its electrical conductivity.

This determination was carried out by a telephonic measurement, using the alternating current method of KOHLRAUSCH, in a thermostat at  $18^\circ\text{C}$ , where the temperature did not vary more than  $\pm 0.05^\circ\text{C}$ . The resistance of the electrodes was determined on a saturated solution of gypsum. The conductivity of the aqueous extracts was very weak, and in order to show its value better, the author has multiplied the value of  $\alpha$  by the factor  $10^6$ . The conductivity was determined of the aqueous extract of the top layers of about 40 different soils. The Table quoted shows the results that were obtained.

		Conductivity	
I	Forest soils... } 1) Grey forest soil, 9 samples. . . . .	18.4 - 80.3	
	18.4-144.38 } 2) Brown forest soil, 3 samples. . . . .	75.6 - 144.38	
II	Steppe soils.. } 1) Prairie clay, 3 samples. . . . .	71.3 - 88.23	
		2) Black steppe soil, 2 samples. . . . .	51.9 - 133.75
		3) Brown steppe soil, 8 samples. . . . .	69.2 - 203.0
		4) Salt soil, 5 samples. . . . .	43.16- 1364.0
III	Non-zonal } 1) Alluvial soil, 3 samples. . . . .	64.0 - 1047.52	
	soils . . . . } 2) Sandy soil, 7 samples. . . . .	14.7 - 249.49	
14.7-1047.52			

The numbers obtained show such a great difference between the extremes of conductivity. Further the fact must be taken into account that if, in cultivating the soil, the layers of the soil are mixed, then the new upper layer formed has another conductivity. The electrical conductivity of the aqueous soil-extract only represents the relative content of soluble salts in the soils, and is therefore of no use for the classification of soils.

**122 - New Phospatic Limestone Deposits in Mexico.** — FLORES TEODORO, in *Memorias y Revista de la Sociedad Científica Antonio Alzate*, Vol. 34, No. 10, pp. 351-362, 5 plates, Mexico, October 1916.

On the southern slope of the Cerro de Topo Chico, about 4 miles to the north-west of Monterrey and some 2200 feet about sea-level,

the writer has discovered a deposit of phosphate of lime. A survey has already been begun. The mineral is concretionary in form and of varying structure — oolitic — mammillated — compact — earthy — in concentric layers. The samples analysed at the Chemical Laboratory of the National Geological Institute of Mexico contained at least 75.98 % of tricalcic phosphate. Apparently it is a case of secondary phosphates formed by dissolution, transport and concentration of the phosphate contained in the volcanic ash or in the lapilli of the district (Cretaceous), either in the form of apatites or in the form of phosphated organic detritus; or possibly it may also be a question of phosphates derived from the Jurassic rocks which should be present to a considerable depth in the region of Monterrey.

123 - **Experimental Kelp Plant at Summerland, California** (1). — *Engineering and Mining Journal*, Vol. CII, No. 25, p. 1070. New York, December 16, 1916.

The Bureau of Soils of the Department of Agriculture is preparing to erect at Summerland, Calif., an experimental plant for the production of potash from Pacific Coast kelp. The details of the plant are not completely developed yet, but Mr D. F. HOUSTON, Secretary of Agriculture, states that the plans contemplate the drying of the kelp as it comes from the water in a series of rotary driers, after which the dried material will be distilled in retorts analogous to a byproduct coke oven.

Ammonia, combustible gas, tar and some other materials will be recovered, and the resulting charcoal will contain the potash salts. These will be leached out and recovered by evaporation, after which the charcoal will be available either as a marketable commodity or as fuel. By recovering the various byproducts and saving the heat units involved in the combustion of the kelp, the Bureau of Soils hopes to develop a process that will permit the continued production of potash from this American source (2).

124 - **Soil Fertilisation by means of Bacteria: Results of Experiments made in 1915 with the Preparation from the Bacteriological Laboratory of the Russian Department of Agriculture.** — Макриновъ И. А. (МАКРИНОВ I. A.), in *Результаты применения бактериальных земледобрильных препаратовъ въ опытахъ 1915 года* (Results of Experiments with Fertilising Preparations of Bacteria in 1915), IV + 83 pp. Petrograd 1916.

In a previous work (3); the writer had shown that the frequent want of success attending the use of bacterial fertilising preparations was not due to the method of inoculating the soil with the bacteria for increasing its nitrogen content, but must be attributed to: 1) the inferior quality of the preparations employed; 2) the irrational use of the said preparations.

(1) The Manurial Research Department of the Soils Bureau has been separated to form the «Bureau of Fertilisers» as an independent Division of the Agricultural Department of the United States. — See: *The American Fertilisers*, XLV, 40a, Dec. 9, 1916. (Ed.)

(2) See B. 1916, No. 1261; B. Jan. 1917, No. 91. (Ed.)

(3) Макриновъ И. А. (МАКРИНОВ J. A.) *Бактериальные земледобрильные препараты и ихъ практическое применение*. (Bacterial Fertilising Preparations and their Use), III + 100 pp. Petrograd 1915.

The writer, with the support of the Department of Agriculture, organized a series of experiments in different parts of the Russian Empire. It had been intended to carry out 300 experiments, but owing to the difficult times, the number was reduced to 68. Several officials of the said Department and of the "zemstvos", as well as some private agriculturists, took part in these experiments. The area of the experimental plots varied from 4.55 to 4100 square metres.

The bacterial preparation was made by the writer himself, it was a pure culture of *Bacillus radicolica* in a liquid medium and contained the strains adapted to clover, vetch and lupin; a pure culture of *Azotobacter chroococcum* being also added. In order to obtain a predominance of *B. radicolica*, which is the chief agent, as it exercises a direct action upon the plant, the sterile medium was first inoculated with this bacterium and then with the culture of *Azotobacter*, either after 1 day, or only after the *B. radicolica* had begun development.

The preparation contained about 200 cc. of nutritive culture, an amount sufficient to infect enough small seeds (clover and lucerne) to sow 1 hectare (= 2.47 acres); in the case of larger seeds such as vetch, however, it is necessary to add cold or boiled milk, or plain water, in order to increase the quantity.

The preparation was considered to be of good quality when it contained *Bacteria radicolica* which were not only capable of growing in the usual cultural media but also possessed, in some measure, the property of assimilating free nitrogen and the power of developing on the roots of the plant.

An enquiry as to the results of each experiment was made on a printed form and the following facts ascertained;

1) The result was negative in 8.8 per cent of the total number of experiments (68). This was a lower proportion than that obtained in similar experiments carried out in Western Europe and in America.

2) In all the other experiments, the increase in yield varied within very wide limits; 5.7 to 108.7 per cent; but the extremes were observed in only a few cases. The increase varied from 5.6 to 10 per cent in 2 experiments and from 100 to 108.7 per cent in 2 others; in a large number of experiments (30) the increase in the crop varied from 20 to 40 per cent.

On arranging the results of the enquiry in different groups according to the fertilisers applied, the increase in the yields is found to be as follows:

Fertiliser	Increase in Yield
None . . . . .	36.1 %
Lime . . . . .	32.0
Basic Slag . . . . .	29.3
Basic Slag + potassic salts . . . . .	47.0
Superphosphate . . . . .	32.8
Superphosphate + potassic salts . . . . .	12.5

3) The other good result of the inoculation of the soil, namely the increase in the number of nodules on the roots of the infected plants, as compared with the uninfected ones, was more stable and more noticeable



than the increase in the yield. In fact in almost every case, an increase in the number of nodules was observed, and as a rule the effect of inoculation was all the more striking owing to the great difference in the number of the nodules present on the infected and uninfected plants respectively.

4) In many cases, a better development of the root system was observed and it may be said that the increase in the number of nodules was accompanied by an increase in the root mass.

5) Many workers have observed more rapid growth and earlier maturity in the case of the plants in the inoculated plot. On one occasion, they were ripe 6 days sooner than the plants of the control plot.

On the basis of the results obtained the writer has drawn the following conclusions

1) The chief factor upon which success in soil inoculation depends, is the quality of the bacterial preparation, that is to say, the activity of *B. radicola*. Indeed, in 2 cases where the action of the bacteria was weak (as was shown by an examination of the preparation carried out in the laboratory) the results of the experiment were negative, in spite of all the other conditions being favourable.

2) Mineral fertilisers greatly contribute to increase the effect of soil inoculation. The following are specially useful: a) Lime; b) Basic slag; c) superphosphate + lime; d) Basic slag + lime; they should therefore be used as much as possible. The writer insists upon the necessity of applying basic slag + lime, even if only in small quantities. To this mixture he attributes a stimulating action both on the plant and the root bacteria. To support his statement he quotes an experiment he carried out in pots, each containing 5 kg. of sand which had been freed from all salts by treatment with acids, and of all organic matter by burning. On adding to each pot a given quantity of nutrient salts, and also, in some cases, a small amount of basic slag (0.75 gr) and lime (0.2 gr.) per pot, it was observed that the growth of the inoculated plants increased.

3) Superphosphate should not be used as a fertiliser, either alone, or with the addition of potassic salts.

4) The results obtained show, that by organising the experiments systematically, and by improving both the bacterial preparation and the technique of its use, it is possible to decrease the number of experiments with negative results and increase the effect of soil inoculation.

125 - **On the Study of the Root System of Cereals.** — Воробьевъ С. И. (VOROBIEV S. I.) in *Сельское Хозяйство и Лесоводство (Agriculture and Sylviculture)*, Vol. CCLII, 66th Year, pp. 477-505. Petrograd, August 1916.

The writer discusses previous researches on the root system of cultivated plants. He considers that, with regard to the analysis of the life of the root from the purely external point of view, these researches have thrown light upon two points only:

1) the depth to which the roots of various cultivated plants penetrate into the soil; 2) the relative position which the mass of the roots assume in the various soil layers where they occur. If, further, we take into account the fact that ROTMISTROV, by means of special trenches, has

been able to record the growth of the roots day by day, the picture of the linear development of the root in the soil is sufficiently complete and clear.

All preceding work is in agreement with regard to one general fact : in proportion as the plant develops, the roots of cereals diminish gradually in mass as they penetrate into the lower layers, both relatively and absolutely.

Taking as basis this distribution of the root mass in the soil, it is generally admitted that the consumption of water is greater in the layer where this mass is most considerable. The writer shared this opinion himself until he had studied the consumption of water by plants under field conditions, when he observed phenomena which were contradictory to this general opinion. For instance, on a piece of land under winter rye, 3 moisture determinations were made in layers of varying depth and at varying stages in the growth of the plant. The resulting data are shown in the appended table.

*Water consumption by winter rye at varying stages of growth, in layers of varying depth.*

Depth of soil layer	Moisture		
	end of April	coming into ear	maturity
5 cm	26.23 %	17.35	11.00 %
10	32.40	19.91	14.05
25	35.65	16.98	15.09
50	30.39	25.86	16.89
75	27.16	27.19	17.21
100	22.59	26.69	22.30

In this table the writer draws attention to the fact that at the time of coming into ear the rye absorbs moisture with greater intensity at a depth of 25 cm. where, at the end of April the percentage of water was 35.65, whilst at the time of earing it was 16.98 % ; that is to say that during the whole of this period the plant absorbed from this layer 18.67 % (35.65 % - 16.98 %), whereas at a depth of 50 cm. the consumption was only 4.53 % (30.39 % - 25.80 %) and, in the deepest layers the reserve of water had not been touched. If comparison is made of the water percentages at earing and at maturity, it is seen that at this latter period, at a depth of 25 cm. the plant absorbs only 1.89 % (16.98 % - 15.09 %) and that the maximum absorption of water during harvest occurs at a depth of 75 cm. where the diminution of moisture, between earing and maturation, reaches 9.98 % (27.19 % - 17.21 %), whereas in the preceding determination, at the period of earing, the reserves of water at this depth are still intact.

The writer puts forward the following statement based on the foregoing cases and on others observed in the dry regions of South west Russia: absorption of water by the plant at the various stages of its growth is in direct relationship neither with the total area of the root system nor yet with its weight, but is chiefly determined by the size of the *functional* portion of the root.

On this basis the study of the morphology of the root (determination of length and volume) can throw no light on the question of the sum or of the intensity of the physiological work of the root with regard to absorption of soil moisture. Only the dynamical determination of the functional part of the root can aid in elucidating such problems.

Regarding the root hairs as the chief agents in the absorption of water, and attributing to their development the varying consumption of water during the various growth phases of the plant, the writer has conducted experiments on their formation and development. The trial made in 1914 at the Volsk Experimental Field, in order to study the daily growth of the plant by means of a trench 2 metres deep and by replacing one of the walls of this latter by a glass plate 1.5 m.  $1 \times$  m., was unsuccessful as this system only allows the observation of a portion of the root, viz that nearest the glass.

The author then had recourse to a modification of the moist air method used by ARZIKHOVSKIY in his study of gaseous exchanges in the root.

The apparatus consisted of: 1) 2 glass "cloches" placed one above the other, the lower one of which was 75 cm. high and 30 cm. in diameter, and the upper one 76.5 cm. high and 31.5 cm. in diameter, that is to say between the two "cloches" there remained a space of 1.5 cm. for the reception of the root; 2) a dish of water to maintain the air moist between the two "cloches"; 3) two covers to protect the roots from the action of light and heat, the outer one being painted white. Throughout the experiment the apparatus remained in the open.

The roots of germinated grain of *Triticum durum* were introduced through an opening made in the top of the external "cloche". The walls of the chamber formed by those of the two cloches were always covered with water vapour derived from the dish. Mineral nutrition was assured by means of waterings at  $1 \frac{1}{2}$  hour intervals (except at night when they were suspended) with a solution of: calcium nitrate, 1.5 gr. — monopotassic phosphate, 0.5 gr. — potassium chloride, 0.3 gr. — magnesium sulphate, 0.5 gr. — ferric hydrate, 5 drops — water, 1 litre. In order to prevent the nutritive solution from descending too rapidly a little glass-wool was placed around the neck of the root. This did not hinder observation. In these conditions the plant developed absolutely normally to maturity (formation of ripe grain). The first object of the experiments was thus attained. In subsequent researches, by dividing the space between the cloches into sections in the direction of their length, it will be possible to create varying conditions of nutrition and to investigate their influence on the development of the root. Further, by filling these sections with matter of varying density (sand, clay, charcoal, etc.), it will be possible to



determine the manner in which the roots become distributed in the various media.

As regards the development of the functional portion of the root the writer records that, according to his preliminary experiments, the root hairs develop in abundance in the moist air, but that after a time, notwithstanding the conservation of conditions equally favourable to their existence they die off. All this leads to the belief that the idea of taking the root system and considering data on its length, weight and general area is not only one-sided but even erroneous, since two root systems of equal length may still differ in the number of their actively functional roots. Thus the writer considers that the length of the root system can no longer serve "among other data" as a sign of resistance to drought, according to the idea of MODESTOV (1). The best proof of this is to be found among MODESTOV's own data on the length of the root system of pure strains of oats. Taking the length of the root system as a basis for selecting drought resistant plants, the "Gudan" and "Ghigantskij" varieties should undoubtedly be the best for dry regions. But practice shows the contrary is the case: thus, in the South-east of Russia, in 1911, a remarkably dry year, the varieties "rykhlik" and "nemertchansk" have, beyond all others, justified their reputation for drought resistance. But according to MODESTOV's data it is precisely these varieties which have the shortest root system.

The writer considers the question may be resolved by determining the functional area of the root in the different varieties, and it will probably be found that this will be relatively greater in the varieties most resistant to drought.

A thorough study of the extent of the functional area of the root should help to elucidate several experimental facts which are still doubtful and should open up wide horizons in respect of questions relating to soil cultivation, irrigation and manuring.

126 - **Kafir, an Alcohol-soluble Protein from Kafir (*Andropogon Sorghum*).**

— , OHNS CARL O. and BREWSTER J. F., in *The Journal of Biological Chemistry*, Vol. XXVIII, No. 1, pp. 59-65. Baltimore, Md. December, 1916.

Kafir has become an important crop in the United States during the last decade. In 1910, three million acres were under cultivation, and the value of the crop was thirty million dollars. It is known that this cereal contains an alcohol-soluble protein, but hitherto no study has been reported on the proteins of kafir. The seeds used in the writers' experiments were grown in Kansas in 1915 and were of the variety known as dwarf kafir.

Nitrogen determinations on the Kafir meal showed that it contained 11.7 per cent. of protein ( $N \times 6.25$ ). Of this, boiling 60 per cent alcohol extracted 7.9 per cent of protein, based on the nitrogen content of the extract. 5.2 per cent of pure protein was isolated, dried at 110° C., by the use of alcohol ranging from 60 to 70 per cent by volume. As no account

(1) See B. 1916, No. 741.

was taken of the losses occurring in the various manipulations during the preparation of the protein, this yield indicates that most of the nitrogen extracted was in the form of protein. To this alcohol-soluble protein, which constitutes more than one-half of the protein in the seed, the name kafirin has been given. Kafirin resembles zein in its ultimate composition, but is different in physical properties. It contains tryptophane and apparently lysine, both of which are lacking in zein.

Analyses of 13 preparations of kafirin gave the following average results calculated on a moisture-free basis.

*Analyses of Kafirin.*

C . . . . .	55.19 per cent.
H . . . . .	7.36
N . . . . .	16.44
S . . . . .	0.60
O . . . . .	20.41

The distribution of nitrogen was obtained from an analysis made by the VAN SLYKE method. A sample of kafirin containing 16.64 per cent of nitrogen gave the following results, from which it appears that this protein differs from zein in containing distinctly more amide nitrogen as well as basic nitrogen.

*Distribution of Nitrogen in Kafirin and in Zein.*

Nitrogen	Kafirin	Zein *
Humin . . . . .	0.17	0.16
Amide . . . . .	3.46	2.97
Basic . . . . .	1.04	0.49
Non-basic . . . . .	11.97	12.51
	16.64	16.13

\* OSBORNE and HARRIS, *Journal of the American Chemical Society*, 1903. Vol. XXV, p. 323.

The percentage of diamino-acids in kafirin was also determined by the Van Slyke method. The results given below have been corrected for 0.78 per cent of cystine, which was precipitated with the phosphotungstates of the other bases.

	Kafirin	Zein
Arginine . . . . .	1.58	1.55
Lysine . . . . .	0.90	0.00
Histidine . . . . .	1.00	0.82
Tryptophane . . . . .	Present	0.00

\* OSBORNE and JONES, in *American Journal of Physiology*, 1910, XXVI, p. 228.

127 - Some Proteins from the Jack Bean, *Canavalia ensiformis*. — JONES D. BREESE and JOHNS CAR O., in *The Journal of Biological Chemistry*, Vol. XXVIII, No. 1, pp. 67-75. Baltimore, Md., December, 1916.

The writers have isolated from the jack bean two globulins, canavalin and concanavalin. They have the following composition.

	Canavalin	Concanavalin
C . . . . .	53.26	53.28
H . . . . .	7.03	7.02
N . . . . .	16.72	16.45
S . . . . .	0.48	1.10
O . . . . .	22.51	22.15

The distribution of nitrogen in canavalin and in the albumin is the following.

	Nitrogen	Canavalin	Albumin
Humin. . . . .		0.28	0.23
Amide . . . . .		1.41	1.16
Basic . . . . .		3.17	3.73
Non-basic . . . . .		11.55	11.18
Total . . . . .		16.41	16.30

128 - The Proteins of the Peanut, *Arachis hypogaea*: The Globulins Arachin and Conarachin. — JOHNS CARL O. and JONES, D. BREESE, in *The Journal of Biological Chemistry*, Vol. XXVIII, No. 1, pp. 77-87. Baltimore, Md., December, 1916.

The writers have isolated from the peanut two globulins, arachin and conarachin. They have the following composition:

	Arachin	Conarachin
C . . . . .	52.15	51.17
H . . . . .	6.93	6.87
N . . . . .	18.29	18.29
S . . . . .	0.40	1.09
O . . . . .	22.23	22.58

Distribution of Nitrogen			
	in the Arachin	in the Conarachin	in the total Globulins
Amide . . . . .	2.03	2.07	2.08
Humin. . . . .	0.22	0.22	0.21
Basic . . . . .	4.96	6.55	5.23
Non-basic . . . . .	11.07	9.40	10.68
Total . . . . .	18.28	18.24	18.20

The percentage of basic nitrogen in conarachin is the highest one recorded for any seed.

From these results it seems probable that pea-nut presscake will prove



to be highly effective in supplementing food products made from cereals and other seeds whose proteins are deficient in the basic amino-acids. Feeding experiments are in progress to determine the nutritive value of combinations of peanut proteins with other proteins obtained from the more extensively used seeds.

**129 - The Occurrence and Physiological Significance of Flavone Derivatives in Plants. —**

SHIBATA, K.; NAGAI, J. and KISHIDA M. in *The Journal of Biological Chemistry*, Vol. XXVII, No. 1, pp. 92-108, table 1. Baltimore, Md., December, 1916.

The results of the present study are summarized as follows by the writers:

1. The general occurrence of flavone derivatives in the plant kingdom may be taken as established.

2. The occurrence of flavone derivatives in plants is almost exclusively limited to the epidermis and the peripheral parenchymatous layer of the aerial parts with few exceptions on record, in which a considerable amount is also found in the bark and the wood, as in *Myrica rubra*, *Quercus tinctoria*, *Morus tinctoria*, etc.

3. The amount of flavone derivatives contained in the plant tissue can be measured colorimetrically by means of comparing the intensity of reduction colour (anthocyanin) produced by an aqueous or alcoholic extract from the fresh as well as from preserved herbarium (dried) material.

4. It is assumed that flavone derivatives dissolved in the cell sap possess an important physical significance in absorbing ultra-violet rays of the sunlight, by which the living protoplasm and its biochemical agencies are protected from the injurious action of the rays.

5. The plausibility of the above assumption is justified by the results of extensive studies made on plants from alpine and tropical regions where the intensity of the rays considered is high. The plants which are grown in strong insolation are always rich in flavones, except those which are fully protected from the action of the excessive illumination by some means of a morphological and anatomical nature.

6. The green leaves of deciduous trees, which produce anthocyanin pigment in autumn, contain a considerable amount of flavones. The production of autumnal colour (anthocyanin) is due to the biochemical change; i. e. the reduction of already existing flavones in the leaf, initiated by the physiological condition at the end of the growing season of the year, without having special ecological significance.

**130 - Role of Ammonia in the Metabolism of Nitrogenous Substances in Plants. —**

I. PRIANICHNIKOV D. N. *Ammonia as alpha and omega of the metabolism of nitrogenous substances in the plant*, in *Московский Сельскохозяйственный Институтъ. Кафедра Частнаго Земледѣлія. Изъ результатовъ вегетационныхъ опытовъ и лабораторныхъ работъ* (Agronomical Institute of Moscow. Collection of papers from the Agronomical Laboratory under the direction of Prof. D. N. PRIANICHNIKOV), Vol. X, pp. 1-24, Moscow 1916. — II. NICOLAEVA A. G., *Accumulation of asparagine in young shoots of *Lupinus luteus* in conditions of nutrition with various ammoniacal salts*. *Ibid.* pp. 380-383. — III. MOROSOV V. A., *Influence of alkalinity of solutions on the metabolism of nitrogenous substances in young pea shoots*. *Ibid.*, pp. 384-390. — IV. PRIANICHNIKOV

D. N. and KACHEVAROVA O. N., *Influence of carbohydrates on the behaviour of the lupin in connection with ammoniacal salts, influence of ether and other solvents of fats on the germination capacity of the seeds.* — V. KABLOUKOV A. S. *Influence of the removal of the endosperm on the behaviour of young maize shoots in connection with ammonical salts.* *Ibid.*, pp. 155-158.

In 1894, Prof. PRIANICHNIKOV readopted the point of view of BOUSINGAULT with regard to asparagine as an amide analogous to urea, resulting from oxidation processes and remaining unconsumed by the plant as long as the latter remains in darkness (ordinary conditions of germination). In the present work, the author gives the following summary of his researches during the last few years in the Laboratory of which he is Director (1) on the rôle of ammonia in the metabolism of nitrogenous substances :

(1) In the preface to his work. M. PRIANICHNIKOV gives the following data on the work of this laboratory in 1914 in which 120 persons participated — students, assistants, specialists in the Dept. of Agriculture, etc :

	Number of experiments	Number of pots
Experiments with various phosphorites (cereal cultures in sand) . . . . .	8	130
Behaviour of various plants in relation to phosphorites . . . . .	13	206
Action of fertilisers . . . . .	15	253
Phosphates of iron (and other phosphates) . . . . .	4	82
Influence of various forms and quantities of phosphoric anhydride . . . . .	25	342
Influence of calcium carbonate on the assimilation of phosphoric acid . . . . .	1	64
Importance of citric soluble phosphoric acid . . . . .	13	62
Comparison between "normal" nutritive solutions. . . . .	13	505
Sources of potash . . . . .	12	170
Ratio lime:magnesia . . . . .	10	160
Action of salts of briny soils. . . . .	8	116
Lupins and lime . . . . .	1	48
Assimilation of iron . . . . .	1	64
Denitrification . . . . .	8	100
Nitrogenous manures . . . . .	7	108
Experiments with zeolites . . . . .	1	18
Action of moisture . . . . .	3	46
Ash of dried cattle manure . . . . .	2	32
Repeated sowings (Soil fatigue). . . . .	2	400
Experiments with the object of studying farm yard manure . . . . .	1	72
Stimulating fertilisers . . . . .	4	102
Total . . . . .	142	3080

The total number of 3080 pots may be analysed as follows :

253 water cultures  
2198 sand »  
629 soil »

Recent research has shown that ammonia plays an important part in the life of the higher plants, not merely as a point of departure in the synthesis of proteids but also as the end product of decomposition resulting from the oxidisation of nitrogenous substances. However, in the normal plant, ammonia does not accumulate in the tissues as such; it only gives rise, by means of a secondary synthesis, to the formation of asparagine. This process serves to eliminate the ammonia injurious to the plant (ammonia derived from without as well as that formed within the cells), by transforming it into a neutral combination, capable of serving subsequently for a more complex synthesis.

The synthesis of asparagine at the expense of the ammonia absorbed by the roots is not accomplished with equal facility among all plants. Previous experiments at the above-mentioned laboratory have resulted in the distinction of 3 types of plants:

1st Type: Plants supporting well dilute solutions of ammonium chloride or ammonium sulphate, readily absorbing ammonia and forming asparagine or glutamine without any need for special precautions. Belonging to this group: *Hordeum sativum* — *Zea Mays* — *Cucurbita Pepo*.

TABLE I. — Quantities and distribution of nitrogen in 100 plants of *Hordeum sativum* and of *Cucurbita Pepo* grown in distilled water and in a solution of ammonium chloride.

	<i>Hordeum sativum</i>		<i>Cucurbita Pepo</i>	
	Distilled water	Ammonium chloride	Distilled water	Ammonium chloride
Total nitrogen . . . .	145.8 mgr.	161.5 mgr.	1438.3 mgr.	1545.4 mgr.
Protein nitrogen . . .	61.8	61.5	1153.0	1049.9
Asparagine nitrogen .	<b>36.7</b>	<b>56.4</b>	<b>193.3</b>	<b>379.3</b>
Ammoniacal nitrogen .	0.5	0.9	8.7	6.4

2nd Type: Plants in which solutions of ammoniacal salts of strong acids retard the decomposition of albuminoid substances and the accumulation of asparagine: absorption of ammonia is very feeble and sometimes almost *nil*, but on introducing calcium carbonate to the solution energetic absorption of ammonia and formation of asparagine is observed. To this type belong: *Pisum sativum* and *Vicia sativa*.

TABLE II. — Quantities and distribution of nitrogen in 100 young plants of *Vicia sativa* and of *Pisum sativum* grown in: distilled water — solution of ammonium chloride — solution of ammonium with addition of calcium carbonate.

	<i>Vicia sativa</i>			<i>Pisum sativum</i>		
	Distilled water	Ammonium chloride	Ammonium chloride + calcium carbonate	Distilled water	Ammonium chloride	Ammonium chloride + calcium carbonate
Total Nitrogen . . . .	221 mgr.	244 mgr.	263 mgr.	1608 mgr.	1712 mgr.	1810 mgr.
Protein nitrogen . . . .	85	109	90	949	1104	1016
Asparagine nitrogen .	<b>76</b>	<b>73</b>	<b>118</b>	<b>258</b>	<b>283</b>	<b>441</b>
Ammoniacal nitrogen .	0.9	0.9	1	10	10	10



3rd Type: Plants in which nutrition with ammonical salts is capable of causing serious disturbances in the synthetic reactions which manifest themselves in the accumulation of ammonia derived from the decomposition of the nitrogenous substances in the seeds. In this case the addition of calcium carbonate is powerless to re-establish the normal course of the metabolism of nitrogenous substances. The yellow lupin (*Lupinus luteus*) may serve as an example of this type.

TABLE III. — Quantities and distribution of nitrogen in 100 young plants of *Lupinus luteus* grown in: distilled water — solution of ammonium sulphate or ammonium chloride — ammonium sulphate or ammonium chloride solution with addition of calcium carbonate.

	1st experiment			2nd experiment		
	Distilled water	(NH <sub>4</sub> ) <sub>2</sub> SO <sub>4</sub>	(NH <sub>4</sub> ) <sub>2</sub> SO <sub>4</sub> + CaCO <sub>3</sub>	Distilled water	NH <sub>4</sub> Cl	NH <sub>4</sub> Cl + CaCO <sub>3</sub>
Total nitrogen. . . . .	567 mgr.	575 mgr.	535 mgr.	540 mgr.	590 mgr.	417 mgr.
Protein nitrogen. . . . .	152	160	170	194	209	165
Asparagine nitrogen. . . . .	<b>258</b>	<b>175</b>	<b>158</b>	<b>231</b>	<b>231</b>	<b>190</b>
Ammoniacal nitrogen . . . .	26	57	68	9	9	2

Once these 3 types of plants had been established, the object of the subsequent experiments was to explain the characteristic behaviour of the lupin with regard to ammoniacal salts of strong acids: to ascertain, that is, whether the cause resides in the absence of carbohydrates, or, in the case of this factor being of no account, what the real causes may be.

In order to elucidate the rôle played by the reserves of carbohydrates in the economy of the lupin, use may be made of various methods:

- 1) Choice of natural subjects analogous in the composition of their seeds to the lupin, in order to control, by the aid of the constituents of these seeds, the results of experiments made upon the lupin itself.
- 2) Artificial preparation of subjects analogous to the lupin.
- 3) Study of the influence of a special nutrition upon the lupin itself.

The following 2 methods were chosen:

A. — Diminution of the reserves of carbohydrates in Gramineae or in Leguminosae other than the lupin, in order to obtain another physiological type: an "artificial lupin"

B. — Increase of the carbohydrate reserves in the lupin itself.

In both cases it was proposed to observe how such artificially obtained subjects behaved in relation to ammoniacal salts of strong acids.

Method A. — In order to apply this method, i. e. in order to obtain subjects of the lupin type from oil grains or grains rich in carbohydrates, the following methods are capable of being employed:

- 1) Physiological treatment of the seedlings (effect of inanition).
- 2) Mechanical removal of the endosperm or of the cotyledons, in plants attaining a certain degree of development.
- 3) Extraction of the fatty matter of the grain in such a way as not to deprive it of its vitality.

A. G. SMIRNOV has obtained satisfactory results with the first method. The normal behaviour of barley seedlings with regard to ammoniacal salts having been modified by the effects of inanition, the seedlings approached in character the physiological type of the lupin.

These experiments differ from earlier ones made in the same laboratory by G. S. CHOULOV with regard to the length of time the seedlings remained in the dark: this period was increased to 10-21 days. Table IV shows that the mixture of  $\text{NH}_4\text{Cl} + \text{CaCo}_3$  occasioned a diminution in the quantity of asparagine relatively to that of plants grown in distilled water.

TABLE IV. — *Quantities and distribution of nitrogen in 100 seedlings of Hordeum sativum grown in various nutritive media (Experiments of A. G. SMIRNOV).*

Nutritive solutions	Total nitrogen	Protein nitrogen	Asparagin nitrogen	Ammoniacal nitrogen
Distilled water . . . . .	163.3 mgr.	81.6 mgr.	44.8 mgr.	4.1 mgr.
$\text{NH}_4\text{Cl}$ . . . . .	202.1	95.5	57.5	44.2
$\text{NH}_4\text{Cl} + \text{CaCo}_3$ . . . . .	242.1	86.8	37.4 $\longrightarrow$	72.9
$\text{NH}_4\text{Cl} + \text{CaSo}_4$ . . . . .	226.4	83.2	26.1 $\longrightarrow$	69.2
$\text{NH}_4\text{NO}_3$ . . . . .	188.6	77.1	60.0 $\longleftarrow$	17.2
Urea . . . . .	171.0	68.5	66.8 $\longleftarrow$	10.3

The quantity of ammoniacal nitrogen is about twice as great as that of asparagine nitrogen. The same results are obtained with the mixture  $\text{NH}_4\text{Cl} + \text{CaSo}_4$ . There are consequently, in this case, symptoms highly characteristic of the lupin, which are not present in the barley during the early days of its development.

With regard to ammonium nitrate and urea, they have given results analogous to those obtained by MILE. NICOLAIEVA with the lupin, viz: these two sources of nitrogen have not altered the asparagine synthesis.

A control experiment carried out by A. I. SMIRNOV, where the plants were gathered at two different periods, entirely confirmed the data obtained from a comparison of the results of the experiments summarised in Table IV with those of CHOULOV.

TABLE V. — *Quantities and distribution of nitrogen in 100 seedlings of Hordeum sativum grown in various nutritive media and gathered after 11 and 21 days respectively (A. G. SMIRNOV's experiments).*

	Nutritive solutions	Total nitrogen	Protein nitrogen	Asparagin nitrogen	Ammoniacal nitrogen
11 days	Distilled water . . . . .	164.4 mgr.	101.2 mgr.	16.2 mgr.	5.4 mgr.
	$\text{NH}_4\text{Cl}$ . . . . .	181.2	104.1	33.0 $\longleftarrow$	11.7
	$\text{NH}_4\text{Cl} + \text{CaCo}_3$ . . . . .	187.3	98.9	38.8 $\longleftarrow$	13.8
	$\text{NH}_4\text{Cl} + \text{CaSo}_4$ . . . . .	190.8	97.2	33.8 $\longleftarrow$	8.1
21 days	Distilled water . . . . .	164.9	73.8	36.6	7.6
	$\text{NH}_4\text{Cl} + \text{CaSo}_4$ . . . . .	200.2	70.6	26.6 $\longrightarrow$	51.0

Table V shows that the 11 day seedlings have retained their "barley" type (accumulation of asparagin at the expense of ammonia), and that those of 21 days already show the "lupin" type (accumulation of ammonia at the expense of asparagine).

With regard to the experiments with the 2nd method: diminution of the starch reserves by removal of the cotyledons or the endosperm, these were carried out on peas and on maize grains. At present only the results of KABLOUKOV's experiments can be quoted, made on maize seedlings which grew in nutritive solutions for 2 weeks after removal of the endosperm.

TABLE VI. — *Quantities and distribution of nitrogen in 100 seedlings of Zea Mays grown in nutritive solutions for 2 weeks after removal of the endosperm.*

Nutritive solutions	Asparagin nitrogen	Ammoniacal nitrogen
Distilled water. . . . .	28.66 mgr.	6.44 mgr.
NH <sub>4</sub> Cl. . . . .	28.22	14.40
NH <sub>4</sub> Cl + CaCO <sub>3</sub> . . . . .	39.44	23.00

These results lead to the belief that the duration of the experiments was insufficient: thus with regard to asparagin storage the maize gave the "pea" type, but not yet the "lupin" type; on the one hand no diminution of asparagine was observed; on the other, ammonium chloride alone added to the solution did not bring about asparagine synthesis; to obtain this latter it was necessary to add Ca CO<sub>3</sub>. — With regard to the figures in the 2nd column it must be admitted that such an enormous increase of ammonia is not usually observed either in maize or in the pea, and that, in this connection, there is resemblance to the "lupin" type.

Experiments were also made based on the 3rd method: extraction of the fats from the seeds of oil-plants by means of ether, in order to ascertain if complete dessication does or does not preserve the grains from the harmful influence of ether or chloroform, as it does undoubtedly protect them from the effects of high temperatures.

The first experiments made by MILE KACHEVAROV seemed to promise useful results: dried seeds of sunflower deprived of their woody coats and left for a month in ether gave up 50 % of their fat to the solvent and 50 % retained their germination capacity; some even retained it after a whole year in ether.

It was important to know whether these results were not due to the fact that some of the seeds (50 %) were permeable to the ether which dissolved out their fats and thus destroyed their germinating power, whilst others (50 %) remained impermeable to the ether and thus retained their fats and capacity for germination. Subsequent experiments showed that such was indeed the case, for the seeds whose coats were perforated on the side opposite to the germ lost their germinative capacity, in spite of complete drying in the oven and treatment with ether dehydrated



with phosphoric anhydride. However that may be, the experiments on barley, in a state of inanition (quoted above) are sufficient to give an affirmative reply to the question studied following method A; in other words, as a result of their loss of carbohydrates the Gramineae behave, in relation to ammoniacal salts, in the same way as plants of the "lupin" type.

*Method B.* — The question was also put in inverse fashion: can increase in the carbohydrate reserves in the lupin itself modify its behaviour with regard to ammoniacal salts in the sense of an approaching similarity to the "barley" type.

Two methods were used to increase the proportion of carbohydrates in lupin seedlings: one consists in carrying out the experiments in the light under conditions favourable to assimilation; the other consists in nourishing the seedlings with glucose.

As early as 1895 SUZUKI had performed experiments with ammoniacal salts in the presence of light but without determining the ammonia, a fact which induced MILE. KACHEVAROV to repeat the experiments in 1914, in sand cultures.

As it was difficult to foretell the moment where assimilation would be sufficient, and as it was also necessary to ensure the plants' obtaining sufficient reserves of ammoniacal salts, while avoiding an excess of  $\text{NH}_4\text{Cl}$ , the plants were gathered at 3 different periods (after 5-10-15 days exposure to light) and the ammoniacal salt was administered in 3 equal doses.

The results of this experiment showed that assimilation took place and at the same time the lupin had lost its characteristic behaviour towards ammoniacal salts, that is to say, the addition of ammonium chloride alone had brought about a notable increase of asparagine; further, similarly to what is observed in the case of barley grown in the dark (and contrary to what takes place in the lupin in the same conditions), an energetic transformation of ammoniacal nitrogen to asparagin nitrogen was observed in the lupin. Thus when the intake of carbon is made superior to the outgo of this element there is a parallel modification in the behaviour of young lupin seedlings with regard to ammoniacal salts. The "asparagine to ammonia" movement is replaced by the reverse "ammonia to asparagine" movement.

The question, whether the characteristic behaviour of the lupin towards ammoniacal salts of strong acids depends on the insufficient quantity of carbohydrates at its disposal, has been answered in a manner favourable to the idea of a relation between this phenomenon and the quantity of carbohydrates or their accessibility to the plant. It has been seen that by increasing or diminishing the quantity of carbohydrates supplied to the plants it has been possible to cause them to pass from one type to another, so that all plants possessing sufficient resources in carbohydrates appear to have the power of forming asparagine at the expense of ammoniacal salts. On the other hand, in a state of inanition, they become unstable and easily lose the faculty of forming asparagin, evidently on account of the lack of carbon and of the necessity in which they are pla-

ced of continuing the consumption of the chain of still unoxidised carbon atoms which occurs in asparagin and which is necessary to its synthesis.

In the presence of nutritional phenomena pushed to an extreme the characteristics of the species almost disappear and, instead of speaking of the "barley" type, it is permissible to talk in more general fashion of the behaviour shown with regard to ammoniacal salts of vegetable organisms "glutted" with or "starved" of carbohydrates.

The animal organism is more capable than the plant of protecting itself in economic manner against the harmful influence of ammonia, the common end-product of the katabolism of the proteid molecule: the animal eliminates ammonia as urea which contains no more unoxidised carbon and can be excreted without any detriment to the organism (from the point of view of calories). The higher plants, which are usually placed in better conditions than animals with regard to obtaining carbohydrates, allow themselves the luxury of forming an amide rich in carbon asparagine, which in normal conditions may accumulate in the cell sap without causing damage to the plant until a still greater affluence of carbohydrates allows the plant to draw upon the nitrogen of the asparagin in order to form proteins. If, on the other hand, these conditions are lacking, if the plant enters on a period of extreme "fast", then it finds itself in worse circumstances than the animal, because it cannot burn the chain of carbon atoms with impunity till complete extinction: incapable of taking the process as low as urea, it may die of auto-intoxication before starvation has produced its fatal effects.

If the lupin runs more risk in this connection than other plants, it is because the ratio in its seeds, between proteids and carbohydrates, is twice as narrow as in the pea and four times as narrow as in the Gramineae.

131 — **Relation Between Alkalinity of the Cultural Medium and Plant Yield. Experiments made in Russia.** — I. Жемчужниковъ, Е. А. (GEMTCHOUGENIKOV, E. A.), The Relation Between Alkalinity and the Yield of Plants Repeatedly Sown in Sand, in *Московский Сельскохозяйственный Институтъ. Кафедра Частнаго Земледѣлія. Изъ результатовъ вегетационныхъ, опытовъ и лабораторныхъ работъ. Томъ X, подъ редакціей профессора Л. Н. Прянишникова* (Moscow Agricultural Institute, Report of the work of the Agricultural Laboratory under the direction of Professor D. N. Prianichnikov) Year 19, Vol. X, pp. 337-351 + 1 diagram, Moscow, 1916. — II. Якушкинъ Я. В. (Jakouchkine, I. V.) Supplement to E. A. GEMTCHOUGENIKOV's article, *Ibid.*, pp. 352-354.

In his experiments in 1914, M. GEMTCHOUGENIKOV tried to obtain the conditions necessary to explain the effect of the accumulation of bases in sand cultures without having recourse to any direct estimation of the alkalinity of the nutritive substratum.

These conditions were obtained in 2 ways: A) by modifying the nutritive solutions. B) by choosing suitable plants.

A. — MODIFICATION OF NUTRITIVE SOLUTIONS. — 1) A start was made with HELLRIEGELS' solution which contains per litre: 0.31 gr. monopotassic phosphate — 1.1 gr. calcium nitrate — 0.17 gr. potassium chloride —



0.13 gr. magnesium sulphate — 0.05 gr. ferric chloride. This solution produced an excess of bases.

2) If it is the excess of bases which exercises the chief action, the plants should suffer most in the most alkaline solutions. As an "alkaline" solution, one was selected containing per litre 0.55 gr. calcium nitrate — 0.68 gr. potassium nitrate — 0.31 gr. monopotassic phosphate — 0.13 gr. magnesium sulphate — 0.05 gr. ferric chloride — and in which the amount of each of the nitrates corresponded to the same quantity of nitrogen.

On the other hand, if this view is correct, everything that decreases the alkalinity of HELLRIEGEL'S solution should also lessen the inconvenience caused to the plant. With regard to this point the following solutions were employed:

3) PRIANICHNIKOV'S nutritive solution, which is regarded as neutral and contains per litre: 0.39 gr. of bicalcic phosphate — 0.54 gr. ammonium nitrate — 0.77 gr. calcium sulphate — 0.34 gr. potassium chloride — 0.13 gr. magnesium sulphate — 0.05 gr. ferric chloride.

4) The so-called "acid" solution containing per litre: 0.31 gr. monopotassic phosphate — 0.54 gr. ammonium nitrate — 0.17 gr. potassium chloride — 1.16 gr. calcium sulphate — 0.13 g. magnesium sulphate — 0.05 gr. ferric chloride. This solution gives an acid reaction, at least, when the plants begin to grow.

5) HELLRIEGEL'S solution acidified by the substitution of 0.30 gr. of superphosphate for 0.31 gr. of monopotassic phosphate.

In addition to these 5 solutions, the following was also employed.

6) CRONE'S nutritive solution containing per litre: 2.25 gr. potassium nitrate — 1.12 gr. magnesium sulphate — 0.56 gr. tricalcic phosphate — 0.56 gr. iron phosphate — 1.12 gr. calcium sulphate.

B. — CHOICE OF SUITABLE PLANTS. — As fundamental species were selected: *Camelina sativa* which cannot stand repeated sowing in HELLRIEGEL'S solution, and *Lupinus luteus* which, on account of its tendency to increase the acid content of the medium in which it is grown, belongs to another category of plants. The experiments, indeed, proved that the lupin had scarcely suffered at all from the repeated sowing.

As successors to *Camelina sativa*, and in order to correct the alkalinity of the soil due to the latter, were sown other plants such as buckwheat and hemp which behave in a manner similar to the lupin.

The first sowing took place at the end of May, there being 3 sowings in all, at an interval of about 1 month. After each harvest, 200 gr. of sand were taken from each pot (containing 4.5 kg. of sand) in order to estimate its alkalinity.

The same amount of fresh sand was added, together with a new supply of nutritive solution for the support of the next crop.

The hemp and buckwheat succeeded *Camelina sativa* in HELLRIEGEL'S solution, but in the solutions with decreased or increased alkalinity, *Camelina sativa* was again planted. Finally, at the 3rd sowing, *C. sativa* replaced all plants which had been used to prepare the medium for it.

In the case of the lupin, the above-mentioned combinations were



somewhat different. CRONE's solution was taken as the basis, and in this medium the plant grew well. The group of acid solutions was excluded, since it was of no interest as regards the lupin. In CRONE's solution, the latter plant was succeeded by: *Camelina sativa*, *Pisum sativum* and buck-wheat.

It was to be expected that, as the lupin accumulates no bases, *C. sativum*, being very susceptible to these compounds, would grow after it very well.

*Conclusions.* — In all the pots from which a 2nd crop was gathered, the alkalinity of the solution at the time was considerably greater than at the date of the first crop.

In a given pot, the 2nd and 3rd crops were sometimes larger than the 1st.

The amount of the 2nd and 3rd crops depended upon the alkalinity left by the preceding plants; the greater the alkalinity of the soil, the poorer the yield, and *vice-versa*.

This accumulated alkalinity would explain to some extent, if not entirely, the decrease in yield observed when plants are repeatedly sown in sand cultures.

II. — In analysing the results of the above-mentioned experiments, M. JAKOUCHKINE draws attention to the circumstance, that in many cases, facts observed were in accordance with expectation. Thus for instance, on comparing the development of plants sown at the same time, the following facts were noted: at the 2nd sowing, the crop produced by *C. sativa* in the alkaline solution was three times less, and the yield was only  $\frac{1}{4}$  less in PRIANICHNIKOV's solution, while in HELLRIEGEL's solution acidified by superphosphate the yield was increased 5 per cent. On the other hand, the sowing in CRONE's solution came to nothing.

On comparing the results of the 2nd and 3rd sowings, it was found that: in the alkaline solution the yield of the 3rd sowing was twice less, while in the acid solution the 2nd and 3rd sowings produced equal crops and finally in PRIANICHNIKOV's solution the 3rd sowing even produced a somewhat larger yield.

In the case of the lupin, about the same relations were found to exist between the effects of the different solutions. Thus in the 2nd sowing the crop raised in the alkaline solution showed a decrease (— 12 per cent), while that raised in PRIANICHNIKOV's solution showed an increase (+ 10 per cent). Only in the case of the alkaline solution was any decrease observed between the yield of the 2nd and 3rd sowings. It was found that the lupin reduces to a certain extent the accumulation of bases in the nutritive solution, owing to its property of increasing the acid content of the solution.

The differences between the other plants tested were less marked.

M. JAKOUCHKINE points out that the principal conclusion to be drawn from M. GEMTCHOUGHENIKOV's experiments is that all modifications which hinder the accumulation of bases in the solution in which the plant is growing, are of assistance to it.

- 132 - **Effect on Plant Growth of Sodium Salts in the Soil.** — HEADLEY F. B., CURTIS, E. W. and SCOFIELD, C. S. in *Journal of Agricultural Research*, Vol. VI, No. 22, pp. 857-869, fig. 1-8. Washington, D. C., August, 28, 1916.

In connection with an attempt to utilise for crop production certain salt land on the Truckee-Carson Field Station at Fallon, (Nevada, United States), it has been necessary to make numerous determinations as to the limit of the salt content tolerated by crop plants. These determinations have shown that this limit of tolerance is extremely variable. Not only is it influenced by many factors, such as the nature of the soil, the kind of salt, and the species of plant, but the same crop plant shows marked differences in tolerance at different periods of its growth. These facts make the problem of the efficient reclamation of alkaline land a very difficult one.

In the present instance, the most abundant and deleterious salts are those of sodium and they occur as carbonates, bicarbonates, chlorides and sulphates. As the proportions in which these salts are found in the different parts of the Field Station are very variable, the writers thought it necessary to carry out a series of pot cultures with wheat; they used soil to which had been added known quantities of these different salts.

These laboratory experiments brought out the fact that only a part of the salt added to the soil in pot cultures could later be recovered from it by water digestion. This apparent loss of salt, which was probably due to absorption by the soil, was greater in the case of sodium carbonate and sodium sulphate than with sodium chloride. The absorption of sodium carbonate was greater in fine soil, rich in organic matter, than in sand. The limit of tolerance for crop plants to the salt in the soil is determined by the quantity of salt that can be recovered from the soil, rather than by the quantity added to the soil. The carbonates and bicarbonates of sodium are mutually interchangeable and the toxicity of the soil solution appears to depend upon the quantity of the basic radical regardless of the form of the acid radical. In the case of the soil from the field under consideration, the proportion of recoverable salt which would reduce by one half the growth of wheat seedlings (which represents the critical point of toxicity) was for the carbonates 0.04 per cent of the dry weight of the soil; for the chlorides 0.16 per cent and for the sulphates, 0.35 per cent.

On the other hand, the proportion of the recoverable salt which prevented germination of wheat was, for the carbonates 0.13 per cent, for the chlorides 0.52 per cent, and for the sulphates 0.56 per cent.

- 133 - **The Function of Calcium in the Nutrition of Garden Pea Seedlings with Ammoniacal Salts.** — Морозовъ В. А. (MOROSOV, V. A.), in *Московский Сельскохозяйственный Институтъ. Кафедра Частнаго Земледѣлія. Изъ результатовъ вегетационныхъ опытовъ и лабораторныхъ работъ* (Moscow Institute of Agriculture, Papers from the Laboratory of Prof. Prianichnikov) Vol. X, pp. 391-395. Moscow, 1916.

Experiments on the assimilation of ammoniacal salts by seedlings in the dark show that the accumulation of asparagine in the young plants occurs at the expense of the ammonia absorbed from without. Ammoniacal salts belong to the group of physiologically acid salts which are not

integrally absorbed by the roots of the plant, but which, under their influence, split up into a base and an acid. The base is absorbed and the acid remains. Consequently it is obvious that ammoniacal salts, in this case the sulphate, can only be of nutritive value to the plant where the acid radical is neutralised by a base.

In the present experiments the following nutritive solutions were used: water — ammonium sulphate — ammonium sulphate + calcium carbonate — ammonium sulphate + ferric hydrate.

Calcium carbonate and ferric hydrate were thus employed to neutralise the acidity in order to study whether the action of the former is confined merely to the neutralisation of the environment or whether it exercises any special action through the nutritive properties of calcium as such. The experiment was carried out as follows: seeds of the Garden pea (*Pisum sativum* var. *saccharatum*) were allowed to swell in distilled water for 24 hours and germinated on paper. When the roots were 3 to 4 cms. in length the seedlings were transferred to vessels containing the above named nutritive solutions, and at the end of a fortnight removed, dried and weighed.

Comparison of the average lengths of roots, stems and weight of roots, stems and weight of 100 germs, shows that the best development was obtained in the vessels containing calcium carbonate; next came ferric hydrate, then distilled water and finally the pure solution of ammonium sulphate.

In the dried seedlings determination was made of the protein nitrogen, asparagine nitrogen, ammoniacal and total nitrogen. The results are summarised in the appended Table.

Nutritive solutions	Total Nitrogen		Protein Nitrogen		Asparagine Nitrogen		Ammoniacal Nitrogen	
	%	Absolute quantity in 100 seedlings	%	Absolute quantity in 100 seedlings	%	Absolute quantity in 100 seedlings	%	Absolute quantity in 100 seedlings
Distilled water . . .	4.50	1179.20 gr	2.32	607.85 gr	1.30	340.60 gr	0.03	7.86 gr
Pure solution d'ammonium sulphate. . .	4.50	1220.15	2.46	652.52	1.18	312.99	0.03	8.55
Ammonium sulphate + ferric hydrate . .	4.91	1229.01	2.37	593.22	1.58	395.48	0.03	7.50
Ammonium sulphate + calcium carbonate	5.91	1241.84	1.84	240.25	2.02	483.33	0.02	7.78

This Table shows that the accumulation of ammonia occurs in opposite sense to that followed by asparagine. The substitution of calcium carbonate by ferric hydrate was of advantage, but the action of the former was more energetic. Probably calcium carbonate does not act merely as



a neutraliser of the medium but account must also be taken of the calcium which, occurring in easily assimilable form in the solution, increases the metabolism of the plant.

**134- Daily Transpiration During the Normal Growth Period and Its Correlation with the Weather.** — BRIGGS, L. J. (Biophysicist in Charge, Biophysical Investigations, Bureau of Industry, U. S. Dept. of Agriculture) and SHANTZ, H. L. (Plant Physiologist, Alkali and Drought Resistant Plant Investigations, Bureau of Plant Industry, U. S. Dept. of Agriculture). *Journal of Agricultural Research*, Vol. VII, No. 4, pp. 156-212, figs. 1-18, pls. 5-6. Washington, D. C., 1916.

This paper deals with crop plants transpiration studies at Akron, Colo. during the summers of 1914 and 1915; the principal objects being the determination of the march of transpiration during the growth period, and the extent to which the daily transpiration is correlated with various weather factors.

The crop plants included in the experiments were grown in large pots (115 kg. of soils) and sealed to prevent evaporation from the soil surface. The pots were weighed each morning before the transpiration response to sunlight had set in. Six pots of each crop were used in the determinations, and were weighed to 0.1 kg. Twenty-one crops (126 pots) were included in the 1914 measurement and 23 crops (128 pots) in 1915. The plants used in 1914 transpiration measurements were:

Kubanka and Galgalos wheat, Swedish Select and Burt oat, Hannchen barley, spring rye, cowpea, white lupine, Kursk and Siberian Millet, Northwestern Dent and Algeria corn, Minnesota and Dakota Amber sorghum, Sudan grass screened and in open, amaranthus, Grimm alfalfa E 23-20-52, Grimm Alfalfa E 23 screened and in open, Grimm alfalfa 162-98 A.

Those used in 1915 were:

Kubanka, Galgalos, Washington, Bluestem, Turkestan, Marquis, Kubanka and Preston wheat, Swedish Select and Burt oat, Hannchen barley, spring rye, North Dakota flax C. I. 13 and C. I. 19, Smyrna Flax, cowpea, millet, sorghum, corn, potato, amaranthus, Sudan grass, Grimm alfalfa E 23 and 162-98 A<sub>1</sub>.

Continuous automatic records were also obtained of air temperature, solar radiation, wet-bulb depression, wind velocity, evaporation from a shallow tank and evaporation from a deep tank. The climatic conditions were exceptionally uniform throughout the season of 1914. The summer of 1915 was unusually rainy.

During a 10-day period of maximum transpiration the annual crops lost about one-fourth of the total water lost during the season. The alfalfas lost during this period almost one-half of the total water transpired in the production of the second crop.

During a 10-day period of maximum transpiration the daily loss of wazer from the small grains ranged from 12 to 16 times the dry weight of the crop; millets, corn, and sorghums, 6 to 9 times; and alfalfas, 36 to 56 times the dry weight harvested. On the basis of a production of 1 ton of dry matter per acre this would correspond in the case of the small grains

to a daily loss of 0.11 to 0.14 acre-inch of water ; corn, millet, and sorghum, 0.05 to 0.08 acre-inch ; and alfalfas, 0.32 to 0.49 acre-inch.

The loss of water from the small grains during the period of maximum transpiration amounted to 1.5 kg. per square meter of plant surface per day ; Sudan grass, 0.8 kg. and alfalfa, 1.6 kg. This is from 5 to 14 per cent of the loss during the same period from a free water surface of equal area.

The transpiration of the different crop plants per unit area of plant surface shows less variation than the transpiration per unit weight of dry matter. In other words, the greater efficiency shown by certain plants in the use of water appears to be due more to a reduction in plant surface than to a reduction in transpiration per unit area of surface. The direct solar radiation received by the plants at Akron is usually not sufficient to account for the observed transpiration during the midday hours. In some of the small grains the energy dissipated through transpiration is twice the amount received directly from the sun.

The march of the transpiration due to changes in the plant alone (change in the transpiration coefficient) may be expressed by the ratio of the daily transpiration to the daily evaporation, if we assume the latter to constitute a perfect summation of the weather conditions determining transpiration. The transpiration of the annual crop plants (aside from fluctuations due to weather) rises to a maximum a little beyond the middle of the growth period and then decreases until the plants are harvested. Perennial forage crop such as alfalfa increase steadily in transpiration to a maximum at or near the time of cutting. Various crops show their individuality by departing more or less from these types.

The transpiration coefficient of many of the crops increases exponentially during the early stages of growth. Sudan grass, for example, doubled its transpiration coefficient every four days during the early growth period. Alfalfa throughout practically the whole period between cuttings doubled its transpiration every eight days. The relative change in the transpiration coefficients of two crops may be determined by taking the ratio of the transpiration of the two crops day by day without the necessity of correcting for changes in weather.

The correlation has been determined between the various physical factors of environment and the transpiration of the different crops, considered both individually and as one population. The correlation coefficients in the latter case for the season of 1914 are as follows: Transpiration with radiation,  $0.50 \pm 0.01$  ; with temperature,  $0.64 \pm 0.01$  ; wet-bulb depression,  $0.79 \pm 0.01$  ; with evaporation (shallow tank),  $0.72 \pm 0.01$  ; with evaporation (deep tank),  $0.63 \pm 0.01$  ; and with wind velocity,  $0.26 \pm 0.01$ .

The small grains show individually a markedly higher correlation between transpiration and the intensity of the various physical factors than was observed when all the crops were combined in one population. The mean correlation coefficients for the small grains (1914) are as follows: Transpiration with radiation, 0.65 ; with temperature, 0.71 ; with wet bulb



depression, 0.88 ; with evaporation (shallow tank), 0.87 ; with evaporation (deep tank), 0.75 ; with wind velocity, 0.22.

The corn, sorghum, and millet group and the legume group show a somewhat lower correlation between transpiration and the intensity of the physical factors of environment. The plants in the various groups, however, show the same relative dependence of transpiration upon the physical factors. Wet-bulb depression and evaporation (shallow tank) exhibit the highest correlation with transpiration in all cases, while wind velocity is correlated with transpiration to a very slight extent at Akron.

The degree of dependence of transpiration of the small grains in 1914 upon radiation temperature, wet bulb depression and wind velocity, considered as independent causative factors, as shown by the squares of the correlation coefficients is as follows : Wet-bulb depression, 0.77 ; temperature, 0.50 ; radiation, 0.42 ; and wind velocity, 0.05. Since the sum of these squares exceeds unity, the physical factors are evidently intercorrelated. The association of transpiration of the small grains with evaporation (shallow tank) is 0.76, or the same as with wet bulb depression.

PLANT  
BREEDING

135 - "Fylgia", "Extra Squarehead III", "Sol II", "Pansar", "Thule II", Varieties of Wheat selected at Svalöf, Sweden. — NILSSON-EHLE, H. ; in *Sveriges Utsäde forenings Tidskrift*, Year XXVI, Part 3, pp. 97-101 ; 106-108 ; 109-112 + 1 Plate ; 113-114 ; 115-118. Malmö, 1916.

The "Fylgia" variety of wheat, which has been selected and cultivated for a long experimental period at Svalöf, is now grown on a large scale, and is deservedly a favourite with all the farmers of Scania (south Sweden). With the exception of "Pansar", a variety which is equally productive, "Fylgia" is, as regards grain yield, distinctly superior to the most commonly cultivated types of wheat, as is shown by the following figures : "Fylgia" 4 294 kg. per ha. (1). — "Pansar" 4292 kg. — "Tystoffe" Smaahvede" 4 202 kg. — "Sol" 3 964 kg. — "Extra Squarehead II" 3 826 kg. — "Weibulls Iduna" 3 758 kg. These data represent the average result of 33 series of experiments in cultivation carried out in the 2 districts of Malmöhus and Kristianstad (Skåne), during the period 1911-1915. They show that the "Fylgia" variety surpasses the others by 400 kg. per ha. on an average — a by no means negligible figure. The types "Fylgia" and "Pansar", on the other hand, are equal, and each enjoys priority according to the weather, or the local soil conditions.

Preference should be given to the "Pansar" variety on stiff cold clays, which are unsuitable for "Fylgia", a wheat requiring a light warm soil. This at Svalöf, where impermeable, heavy soils predominate, "Pansar" gives the larger crop.

TABLE I. — Comparative grain yields per hectare of the varieties "Pansar" and "Fylgia" at Svalöf during the period 1912-1915.

Varieties	1912	1913	1914	1915	Average	Relative Productivity
"Pansar" . .	4 950 kg.	6 160 kg	4 670 kg.	5 830 kg.	5 400 kg.	106.5
"Fylgia" . .	4 750	5 980	4 570	4 970	5 070	100.0

(1) 1 000 kilos per hectare = 7.965 cwt. per acre.

(Ed.)



These two types of wheat are also distinguished from one another by their growth period, "Fylgia" being the first to ripen. This is a great advantage, for it is always useful, on large farms, to have varieties which are equally productive, but ripen at different times for it facilitates harvest operations, by allowing them to be divided. The superiority of the "Fylgia" variety over the "Smaahvede", which is due to its greater resistance to cold, was especially apparent in 1915 in Östergötland, where the winter being very severe, "Fylgia" exceeded "Smaahvede" in grain yield by 25 per cent. The yields given in Table II, were obtained at Svalöf during the period 1912-1915.

TABLE II. — *Comparative grain yields per hectare of the varieties "Fylgia" and "Smaahvede" at Svalöf, during the period 1912-1915.*

Varieties	1912	1913	1914	1915	Average	Relative Productivity
"Fylgia" . .	4 750 kg.	5 980 kg.	4 570 kg.	4 970 kg.	5 070 kg.	101.8
"Smaahvede" .	4 350	5 830	4 600	5 130	4 980	100.0

As is well known, "Fylgia" is the result of crossing "Extra Squarehead II" with "Tystofte Smaahvede". The first of these varieties is distinguished by its cold resistance and the elasticity of its straw and the second, by its large yield and resistance to rust. That wheats can be improved by selection, is shown by the "Fylgia" hybrid which, while it unites in itself the best characters of its parents, surpasses them both in yield, and is an excellent type of a prolific and cold resistant variety. In reality "Fylgia" might be termed an acclimatised "Smaahvede". The former is not only distinguished by its large yield, but also by the great weight of the grain per hectolitre, it is only inferior to "Sol" in this respect, as is seen from Table III.

TABLE III. — *Comparative weights of 1 hectolitre (l) of grain of different kinds of wheat at Svalöf, during the period 1913-1915.*

Varieties	1913	1914	1915	Average
"Fylgia" . . . . .	80.7 kg.	75.6 kg.	79.0 kg.	78.4
"Smaahvede" . . . . .	80.0	77.1	79.4	78.8
"Sol" . . . . .	79.6	77.6	79.7	79.0
"Extra Square-head II" . .	78.3	74.0	77.2	76.5

"Fylgia", like "Pansar" is one of the best types for Scania, and could also certainly be cultivated with advantage in other districts of south Sweden: Blekinge, St. Kalmar, Öland and Gotland.. The variety "Extra-Squarehead II", was cultivated on an extensive scale in 1909; it has spread rapidly to Scania, principally on account of the characteristic strength of its haulms. Of late years, other more productive types ("Fylgia", "Pansar"), have gradually appeared on the markets and have been generally

(1) 1 hectolitre = 2.751 bushels.

(Ed.)

grown, none of them however, could compete with "Extra-Squarehead" from the point of view of the strength of the straw. On the other hand, the crossing experiments carried out for the purpose of combining in one individual the character of "Extra Squarehead" and the productivity of other types, did not give positive results. It was therefore thought best at Svalöf to experiment further with the "Extra Squarehead II" variety with the object of increasing its productivity without lessening the strength of the straw.

"Extra-Squarehead II" is the result of crossing the varieties "Extra Squarehead I" and "Grenadier I". The former is distinguished by its resistance to cold and rust, and the latter by its strong straw and high yield. The hybrid combines the positive characters of both parents, but they are not combined in the best possible manner. Experience has shown that certain characters (in this instance, productivity) are not only correlated with a single element, but often with several. Thus, it may well happen, that "Extra Squarehead II" only contains some of the determinants (those giving rise to productivity) which are present in "Grenadier", in which case, the latter variety would be a good type to use in further selection.

For this reason, the writer tried to make a 2nd cross, this time between "Extra Squarehead II" and the parent variety "Grenadier". The immediate results were as he had foreseen, for in spite of the close relationship existing between "Grenadier" and "Extra Squarehead II", the hybrids of the 1st and 2nd generations presented many variations and new combinations, some of which were of practical importance. This was especially the case as regards the line 088r which came into general cultivation in 1916, under the name of "Extra-Squarehead III". This new variety combines strength of straw with greater productivity than is shown by "Extra Squarehead II", as is proved by the comparative cultural experiments made at Svalöf during the period 1912-1915. (See Table IV).

TABLE IV. — *Yield of grain per hectare produced by "Extra Squarehead III" and "Extra Squarehead II" at Svalöf during the period 1912-1915.*

Varieties	1912	1913	1914	1915	Average	Comparative Index
"Extra Square-head III" . . .	4 390 kg.	5 560 kg.	4 460 kg.	4 646 kg.	4 763 kg.	102.5
"Extra Square-head II" . .	4 010	5 500	4 330	4 740	4 645	100.0

An improvement is noticeable not only in the yield, but also in the grain weight per hectolitre. (See Table V).

TABLE V. — *Weight of 1 hectolitre of grain produced by the varieties "Extra Squarehead III" and "Extra Squarehead II" at Svalöf during the period 1912-1915.*

Varieties	1912	1913	1914	1915	Average
"Extra Square-head III"	76.8 kg.	79.2	76.3	79.7	78.0
"Extra Square-head II".	75.2	78.3	74.0	77.2	76.2

The creation of "Extra Squarehead III" is also, of some historical importance, for it is the first variety of wheat obtained at Svalöf by crossing a hybrid with one of its parents.

This new type does very well in Scania and also, naturally, in all regions where similar conditions of climate and soil exist. "Fylgia" and "Pansar" are, without doubt, the types of wheat best adapted to Scania and the "Pansar" variety at all events, might be successfully introduced into Central Sweden for, in different places in the centre of the country, it has shown a high degree of resistance to cold. This wheat, however, ripens very late, and the further north it is planted (especially in districts with cold damp summer) the more this fact influences the quality of the grain which never attains complete maturity, and consequently its weight per hectolitre is rather low.

Hence, it is necessary to produce early ripening varieties for central Sweden. "Sol" is fairly resistant to cold, it ripens quickly and gives a high yield, thus apparently fulfilling all requirements. Its grain, however, has the defect, when sown in autumn, of germinating very late and in an irregular manner, so that when the cold weather sets in and arrests the growth of the young plants, the latter are still weak and not uniform, which has a bad effect upon the successive phases of development and also upon the harvest.

In order to correct this defect an attempt was made to cross "Sol" with "Extra Squarehead II"; the hybridisations were carried out on such a large scale between 1909 and 1913 that at the 4th generation, the hybrids already filled 226 experiment plots. The very hard winter of 1912 was favourable to the selection of individuals with the greatest cold resistance, as the plants were then exposed to a severe test: "Sol II" was the final result of all this work; it combines, in suitable proportion, the best characters of both its parents, the resistance to cold and the early maturity of "Sol", and the normal method of germination and strength of haulm which are peculiar to "Extra Squarehead II". As regards yield, "Sol II" is as superior to "Sol", as to "Extra Squarehead II".

TABLE VI. — *Yield of grain per hectare produced by "Sol II" compared with the yield of the parent varieties, at Svalöf, during the period 1913-1915.*

Varieties	1913	1914	1915	Average	Comparative Index
"Sol II" . . . . .	5 410 kg.	4 870 kg.	4 960 kg.	5 080	104.3
"Sol I" . . . . .	5 340	4 530	4 740	4 870	100.0
"Extra Square-head II" . . . . .	5 500	4 330	4 740	4 860	99.8

"Sol II" produces 210 kg. per ha., or 4.3 per cent more than "Sol I". Similar results were obtained in Östergötland (the Ullevi and Torshy Stations) and in Uppland (Ultuna Station). The averages obtained during the period 1914-1915 were: "Sol II" 4408 kg., "Sol I" 4152 kg. per ha. In this case, "Sol II" produced 256 kg. per ha., or 6.1 per cent more than "Sol I".



As regards the average weight of 1 hectolitre of grain "Sol II" is superior to "Extra Squarehead", but it is a little inferior to "Sol I". Thus we have the following figures: "Sol I", 79.0 kg., "Sol II", 77.8 kg.; "Extra Squarehead", 76.5 kg.

On the whole, it may be said that "Sol II" is superior to "Sol I" on account of its better germination, the strength of its straw and its high yield. It may be substituted for "Sol I" and can also be introduced into all the provinces of Gotland. Although the "Pansar" variety has already given excellent results when grown on a practical scale, the work of selection has gone on without interruption, with the object of isolating new, and still earlier, short-haulmed lines. Thus, in 1911, one plot was prepared for selection, and 45 of the best plants were chosen in 1912 to be the ancestors of the new lines. The characters of the descendants in 1913, were very diverse. There were great variations amongst the individuals of the various lines as regards precocity, length of straw, appearance of the ears and the average weight of grain per plant. Preference was given to 5 lines out of the whole number, and a series of comparative trials with the ordinary "Pansar" variety undertaken. The new lines, while in no wise inferior to "Pansar", were distinguished by their larger yield, earlier ripening and the strength and length of their straw (which was shorter, and thus more resistant to lodging). The productivity of these lines is shown in Table VII. The area of each experimental plot is 10 square metres.

TABLE VII. — *Comparative productivity of the various "Pansar" lines (grams of grain per plot).*

	Plot I	Plot II	Plot III
Ordinary "Pansar" . . . . .	2 430 gr.	2 800 gr.	5 230 gr.
Line I of "Pansar" . . . . .	2 400	2 560	4 960
Line II of "Pansar" . . . . .	2 290	2 870	5 160
Line III of "Pansar" . . . . .	2 520	2 415	4 935
Line IV of "Pansar" . . . . .	3 000	2 890	5 890
Line V of "Pansar" . . . . .	2 650	2 950	5 600

Owing to these results, lines I, II and III were discarded, the work of selection and comparison being continued on a large scale with the two remaining lines, IV and V. In these cases also, "Pansar II" (line IV) was distinctly superior to the ordinary variety of "Pansar".

	kg. of grain per ha.
"Ordinary Pansar" . . . . .	5 830
Pansar II (Line IV) . . . . .	6 030
Line V of "Pansar" . . . . .	5 990

Other comparative trials are at present in progress at different Stations, and it is very probable that "Pansar II" will gradually be able to replace "Pansar I". At Svalöf, in 1905, the writer crossed the native wheat

(Landthvete) with the "Pudel" variety, and as a result of further selection, he obtained the variety "Thule I". The latter, during, the 5 years of comparative experiments at Svalöf produced, on an average, the same yield as "Pudel" but it was distinctly superior to the latter from the point of view of early ripening. The native type also always remained earlier than the hybrid; therefore it was considered advisable to continue the selection work from 1909-1911, with the object of increasing the precocity of the "Thule I" variety without any diminution of its productivity.

By this selection "Thule II" was obtained, a hybrid which fulfilled the required conditions, for it combines a good yield with the early ripening that makes this type of wheat particularly suited to the climatic conditions of Central Sweden.

TABLE IX. — *Comparative grain yields per hectare of Thule II and other Varieties of wheat grown at Svalöf from 1911-1915.*

Varieties	1911	1912	1913	1914	1915	Average	Comparative Index
0 415 "Sol" . . .	5 320 kg	4 090 kg	5 340 kg	4 530 kg	4 740 kg	4 800 kg	127.2
0 290 "Extra Squa- rehead II" . . .	5 280	3 950	5 500	4 330	4 740	4 760	126.1
0 285 "Thule II"	—	4 320	5 380	3 930	4 560	4 550	121.7
"Renodlad Squa- rehead" . . . .	4 590	4 175	5 480	4 130	4 580	4 590	121.6
0 406 "Bore" . .	4 210	4 150	5 330	4 290	4 670	4 530	120.0
0 820 "Thule I" .	4 980	3 930	5 360	3 860	3 965	4 420	117.1
0 315 "Pudel" . .	4 550	3 990	5 190	3 890	4 400	4 400	116.6
"Landthvete", (native wheat) .	392	3 440	4 650	3 220	3 640	3 775	100.0

Thus, "Thule II" produces on an average 6.8 per cent, (4 550 kg. per ha.) more than "Thule I" (4 280 kg.). In "Thule I", Mr. Nilsson has succeeded in combining in a single type the productivity of "Pudel" with the cold resistance of the native wheat. On the other hand "Thule II" is somewhat more productive than "Pudel" without having forfeited any of its resistance to cold. "Thule II" is superior in yield not only to "Thule I", but also to "Bore" and "Renodlad", although it cannot rival the highly productive varieties, such as "Fylgia" and "Pansar". Its grain weighs, per hectolitre, as much as that of "Landthvete" and more than "Thule I".

TABLE X. — *Weight of 1 hectolitre of "Thule II" grain, compared with the grain of other varieties. Results of experiments made at Svalöf during the period 1912-1915.*

Varieties	1912	1913	1914	1915	Average
"Thule II" . .	77.2 kg	78.9 kg	76.4 kg	78.3	77.7 kg
"Thule I" . .	71.1	78.2	75.9	76.2	76.9
"Pudel" . . .	75.7	77.5	76.9	77.4	76.9
"Landthvete" .	78.1	79.3	76.6	76.5	77.6

"Thule II" is not only a more productive variety than "Thule I", but is also distinguished by its greater resistance to lodging, due to its shorter and stronger straw. The trials made in Östergötland (Central Sweden), confirm the results already obtained at Svalöf.

TABLE XI. — Yield of grain produced per hectare by "Thule II" compared with the yield of other types. Results of experiments made at the Östergötland Station during the period 1912-1915.

Varieties	1914	1915	Average	Comparative Index
o 415 "Sol" . . . . .	3 950 kg	4 860 kg	4 405 kg	120.4
o 290 "Extra Square-head II" . . . . .	4 160	4 550	4 365	119.0
o 825 "Thule II" . . . . .	3 850	4 630	4 240	115.9
o 406 "Bore" . . . . .	3 930	4 530	4 230	115.6
o 315 "Pudel" . . . . .	3 730	4 620	4 175	114.1
o 820 "Thule I" . . . . .	3 730	4 340	4 035	110.2
"Renodlad Squarehead" . . . . .	3 830	4 230	4 030	110.1
"Landthvete" (native wheat) . . . . .	3 840	3 480	3 660	100.0

The creation of "Thule II" is, without doubt, a great advance in the work of selecting types adapted to central Sweden. In no other type are the characters of precocity and resistance to cold and lodging found combined in better proportions with high yield and good quality of grain. Further improvement is moreover still possible. The writer is continuing to cross "Thule II" with the Swedish native wheat, in order to increase its specific cold resistance, and with the best types, (Fylgia", "Pansar") with the object of augmenting its productivity.

136 — **The Selection and Improvement of Indigo in Bihar.** — HOWARD ALBERT and HOWARD GABRIELLE, in *Agricultural Research Institute, Pusa, Bulletin* No. 67, pp. 1-34, 1 Plate. Calcutta 1916.

The two species of indigo cultivated in Bihar are known as Java and Sumatra indigo. The former type, which is preferred, is by no means uniform, for it consists of a number of forms differing: in habit (from tall, erect to short, much-branched forms) — colour of the stems and foliage (greenish, intermediate and reddish) — size and shape of leaflets — time of flowering and root development. The occurrence in the mixture of forms resembling Natal indigo lends colour to the idea that Java indigo arose from a cross between the Natal plant and the species formerly cultivated in Java. At first sight, Java indigo appears to afford an ideal selection ground for the plant breeder. Before, however, considering the methods of improvement by selection adopted in Bihar, the following working conditions must be recapitulated:

1) Cross-pollination is the rule, and is normally brought about by the agency of insects (*Apis florea* and *Halictus gutturosus*).

2) The types composing the crop vary greatly in rapidity of growth and time of flowering. The range in time of flowering is correlated with the development of the root-system — the later kinds are deep-rooted.

3) The late, deep-rooted kinds contain the most indican. Thus



in selection, preference must be given to slow-growing late kinds with penetrating roots. Deep-rooted individuals are very apt to be affected by wilt, a disease which has been very prevalent of late years in the province of Bihar and has reduced the area under Java indigo by about  $\frac{4}{5}$  th. The present selection methods are consequently diametrically opposed to those formerly obtaining, and aim at isolating and propagating early-flowering and vigorous individuals. This is done by two methods.

1) *Mass selection*. — The seed of a large number (200 or 300) of promising, early individuals is collected separately and sown in lines. Careful elimination of unsuitable plants is carried out before flowering begins and a second elimination, a few weeks after, serves to remove all late flowering individuals. The plants which remain supply the seed to be given out to the estates. By this easy method, which can be carried out by any agriculturist, promising results have already been obtained.

2) *Individual selection*. — The only difference between this method and that just described is, that in the present case, the selection is started from one plant, instead of from a group. Experiments are being carried out on the Dholi estate, but they do not seem likely to yield very satisfactory results, for the individuals of a single type get into each others way much more than those constituting a mixture.

#### 137 - Selection Experiments on some Varieties of Raspberries in the United States. —

ANTHONY, R. D. and HEDRICK, U. P., in *New York Agricultural Experiment Station, Geneva, Bulletin No. 417*, pp. 75-88, Plates I - VIII. Geneva, N. Y., March, 1916.

The purple raspberry described for the first time by PECK in 1869 under the name of *Rubus neglectus* is a hybrid of the black-cap and red raspberry. The variability and inconstancy of the colour and appearance of the plant show its origin and nature, as do also the numerous experiments and cultural tests which have been carried out to prove its hybrid character. The popularity of this raspberry has been increasing rapidly and in some regions it has largely supplanted the black-caps, owing to its heavy production and its nearly complete immunity from anthracnose. At present, only 2 varieties of the purple raspberry are known, "Columbian" and "Shaffer" and these are but chance hybrid seedlings.

The success which they have had in so short a time shows the good results and the perfection that can be attained by means of judicious selection.

At the Geneva Agricultural Experiment station, some pure seedlings have been obtained; these give promise of new varieties much superior to any now under cultivation. The best mode of procedure, however, would seem to be to cross the most desirable reds and blacks, rather than to attempt inter-crossing among the purples, or to grow pure seedlings of any purple sorts. Among the red varieties the following were studied: Marlboro, June, Cuthbert, Herbert; and among the black; Cumberland, Hilborn, Palmer and Smith No. 1.

*Marlboro*. — This is an early variety with fruit of good size, but sometimes too soft for shipment and frequently lacking in high quality. The Marlboro appears to possess a factor for spinelessness, a few spineless plants appear-

ing in several of its crosses. From one of its seedlings has been isolated a variety, "June", which is nearly spineless.

*Herbert.* — This variety lacks vigour and many of the plants died before bearing fruit. A few which survived, however, fruited and produced large berries of excellent quality. Hence it would seem that Herbert should be combined with some vigorous variety. Good results were secured by crossing it with June, (a variety descended from Marlboro, which has been described above).

*Cumberland.* — Some very interesting dwarfs appeared among the hybrid purples from Cumberland by June. The dwarf plants had nearly as many nodes as the normal ones but the internodes of the former were much shorter.

*Smith No. 1.* — An excellent variety with large, firm, black fruit of good quality. All the hybrids produced by crossing *Smith* with red varieties were purple, and the black plants which separated out in the  $F_2$  generation had all the characters of the parent. Thus we must consider this variety as homozygous for the black colour factor.

The writer gives some interesting data respecting the inheritance of colour, the shape of the leaves, the presence of spines and the cane characters.

In the case of some, at least, of the above-mentioned characters, it is necessary to admit of the presence of many factors which greatly complicate the genealogical table of the hybrid, but which at the same time render possible an ever-increasing number of combinations. Some of these already seem superior to the purple varieties Columbian and Shaffer, hybrids now in high favour.

Wild varieties of *Rubus* imported from Asia and South America have also been used in the experiments in progress, with a view to combining the high yield and good quality of the cultivated varieties with the power of resistance to disease and unfavourable climatic conditions which belongs to the wild kinds.

### 138 — The Improvement of the Walnut by Selection in California, United States. —

BATCHELOR, I. D., in *The Journal of Heredity*, Vol. VII, No. 2, pp. 61-65, Fig. 4-5. Washington, D. C., February, 1916.

During the last 10 years, the methods of propagating and cultivating the walnut in California have undergone a great revolution, for plantations of grafted trees are beginning to take the place of seedling groves. The best commercial varieties are used as scions. The nuts from many of these grafted varieties, however, fall considerably short of the commercial standard, in fact the produce of one of the heaviest bearing sorts, such as the "Chase", "Prolific" and "El Monte" leaves much to be desired as regards quality, while, on the other hand, the "Placentia", which bears the most ideal commercial nut, is not a heavy producing variety, especially in the northern walnut sections and is quite as susceptible to walnut blight (*Pseudomonas juglandis* Pierce) as the average seedling tree. Again, the "Eureka" variety which is nearly immune from walnut blight on account of its lateness in flowering is a very moderate yielding sort in the southern

sections. These varieties, together with a few others, are the commonest and the most cultivated. The wide range of climatic and soil conditions makes the eventual propagation of quite a large number of varieties inevitable. While the coast regions are bathed in fog nearly every morning during the growing season, the inland valleys experience an extremely dry climate with high maximum temperature. Hence it is necessary to create varieties which are especially adapted to the soil and climatic conditions obtaining in the different districts.

In many of the seedling groves, where the varieties have been propagated without any regard to the good qualities, or defects of the parents, there is a wide range of variability among the individual trees as regards habit, blowing season, character of foliage, resistance to disease, productivity and the shape of the nuts. It is not unusual to find the blooming season in a seedling grove extending over a period of from a month to six weeks. Further, some of the trees are frequently still bare when the nuts of early individuals are of the size of marbles. This variation makes it possible to select and propagate by grafting those kinds which bloom late, and are therefore, better able to resist the spring frosts. What has been said of the flowering season applies also to productivity which varies within very wide limits in the case of trees of the same age and size. Twenty trees in a given row of the same grove varied in productivity as follows. Number of pounds produced by each tree, 1-16-45-10-21-97-20-8-26-0-16-1-18-13-10-21-2-31-7-14.

The shape and the density of the foliage also vary considerably. There are broad-leaved varieties with dense foliage which protects the twigs and trunks from sun-scald. These are best adapted to the inland valleys, where the nuts and leaves often suffer from exposure to the sunshine. On the other hand, the narrow leaved sparsely foliated sorts appear to be less affected by the bacterial disease known as walnut blight, which is especially common in damp districts and on the coast.

Seedling trees differ very much as regards their susceptibility to blight. Among 105 trees in an orchard in Orange County, the percentage of diseased nuts ranged from 6 per cent to 95 per cent, while the average amounted to 47.4 per cent. It might therefore be possible, by careful selection, to isolate types which are nearly immune to this disease.

The nuts are as variable as the trees themselves, the shells vary from extremely rough unattractive specimens to smooth commercial types as the "Placettia", while the colour of the kernels ranges from dark brown to nearly white.

In the selection of varieties the walnut breeder in California is exceptionally favoured by the occurrence of a very large number of seedling trees (about  $1\frac{1}{4}$  million). The first part of the work of selection will consist in isolating the types distinguished by productivity, fruit of good quality, disease resistance and late or early blossoming. In the second period of selection, which will naturally be very long, an attempt should be made to combine in one individual, by means of suitable crossings, the unit characters of sorts not in cultivation; by this means, in the course of time, ex-



cellent results could be obtained. Very little is known at present concerning the correlation of certain desirable, or undesirable, characters of walnut. Researches are now being made at the Citrus Experiment Station (Riverside Cal.) for the purpose of ascertaining these relationships.

#### AGRICULTURAL SEEDS

139 - **Changes in the American Beet-Sugar Industry.** — *Commerce Reports*, No. 268, pp. 596. Washington, D. C., November 14, 1916.

Russia now occupies the chief position as the source of sugar-beet seeds for the United States. Before the war a very large proportion of these seeds came from Germany. A greatly increased total of purchases is shown by figures compiled for the nine months ended September 30, 1916, by the Bureau of Foreign and Domestic Commerce. Record-breaking imports foreshadow great activity in the sugar beet industry in this country.

For the nine months mentioned the imports of seed reached a total of 18 500 000 pounds, which is 1 000 000 pounds more than were imported during the complete calendar years 1913 and 1914, and nearly double those for the full year 1912.

In the fiscal year 1914 Germany supplied nearly 9 000 000 pounds out of a total of 10 250 000 pounds, the remainder coming chiefly from Austria-Hungary, Russia, and Holland. In the fiscal year 1916 Russia supplied 5 881 946 pounds out of a total of 9 042 490 pounds. Imports of beet seed into the United States for the calendar years 1911 to 1916 were as follows:

Years	Pounds	Years	Pounds
1911 . . . . .	11 025 531	1914 . . . . .	17 557 062
1912 . . . . .	9 854 894	1915 . . . . .	4 029 022
1913 . . . . .	17 644 721	1916 (9 months) .	18 474 995

It is an interesting fact that exports of refined sugar in the first nine months of 1916 totalled 1 388 650 984 pounds, or nearly 50 per cent more than during the whole calendar year 1915,  $3\frac{1}{2}$  times more than in 1914, and 26 times more than in 1913.

#### CEREALS

140 - **Cultural Trials of some Native and Foreign Wheats at Pharsalos, Thessaly.** — PAPAGEORGIOS, P., in *Georgikon Deltion Tis Vasilikis Georgikis Etaireias*, Year VIII No. 10-11, pp. 421-429. 3 fig. Athens 1916.

In 1915-1916, the Pharsalos Agronomical Station began a series of comparative trials with certain varieties of native ("Nteven" and "Arnauti") and foreign ("Inversable de Vilmorin", "Risciola bianca di Napoli", Polish wheat *Triticum polonicum*). Among the last named, "Inversable" has already been in cultivation in Thessaly for the last 4 years; the two others were now tried for the first time by the writer.

The characters which make *T. polonicum* especially valuable to Greece are: its resistance to spring droughts, so frequent and harmful in Greece — the firm attachment of the grains to the rachis, which enables the plant to withstand rough treatment without shedding the grain (the Greek wheats, whether owing to the wind, or during harvest and transport, lose on an average 10 % and sometimes as much as 20 %,

of their grain) — its precocity, which enables it partially to avoid the action of the "scirocco" and heavy downpours which often spoil or damage the wheat harvest in Greece. A trial of one year is insufficient to permit of a judgment being formed as to whether Polish wheat will be capable of acclimatisation without loss of its useful characters: if it does prove to be so and if, at the same time, it yields a good crop, it will undoubtedly be adopted by farmers in many parts of Greece.

The variety "Risciola bianca di Napoli" has proved in comparison with local wheats and with *T. polonicum*, very poor in gluten, but on the other hand, very rich in starch. It has also been noticeable for its stout resistance to lodging as a result of the spring storms and in yield it has surpassed, by at least 10 %, all the other varieties tested.

Here, as elsewhere, "Inversable de Vilmorin" is prized for its resistance to lodging, thanks to its stout culm. It is already cultivated in Thessaly, over large areas, especially in low, fairly moist regions with fertile soil.

§ The Pharsalos Station is continuing the study of the above-mentioned wheats and intends to make further trials, in a permanent experimental field, with other varieties of wheat, barley and oats. Under the auspices of the Royal Agricultural Society of Greece, the Station will distribute for trial purposes, samples of seed obtained, to farmers in Thessaly, the Peloponnesus, etc.

141 - The Chemical Composition of the Rices of Bihar and Orissa. — SEN JATINDRA NATH, in *Agricultural Research Institute, Pusa, Bulletin* No. 62, 20 pp. 1 plate. Calcutta, 1916.

Analysis of 18 samples of paddy (unhusked rice) and polished rice from Bihar and Orissa, and, as an appendix, the analysis of 5 types of polished rice from Calcutta. The general results of the analysis of the first 18 samples are given below.

*Average composition of 17 samples of paddy and polished rice*

	Paddy	Polished rice
Weight of 1 litre of paddy in grms . . . . .	583 g	—
Rice yielded per cent. . . . .	—	72.4 %
Moisture . . . . .	11.95 %	10.89 %
<i>Grms per 100 grms air-dry rice:</i>		
Ether extract. . . . .	2.68 g	1.09 g
Albuminoids . . . . .	8.50	8.14
Soluble carbohydrates . . . . .	86.14	89.66
Woody fibre . . . . .	0.86	0.22
Ash . . . . .	1.82	0.89
Albuminoid nitrogen. . . . .	1.36	1.28
Total nitrogen . . . . .	1.38	1.30
Phosphoric Acid . . . . .	0.80	0.40
Potash. . . . .	0.41	0.32

From these results and by comparing them with those of previous authors the author has concluded that:

1) The composition of the rices of Bihar and Orissa is in the main similar to that of other rices analysed by previous workers. They approach, however, those of Burma more closely than they do the rest.

2) With an increase in the albuminoid content of husked rice there is a diminution in the quantity of soluble carbohydrates. On the other hand the low content of albuminoids is associated with increased amounts of soluble carbohydrates. When expressed as percentages of the dry matter, the sum of the albuminoids and soluble carbohydrates generally lies between 94 and 95.

3) The amount of phosphoric acid in a sample of husked rice is just a little less than half of the minerals present. The amount of potash is about half the quantity of phosphoric acid.

4) When rice undergoes polishing it loses much of the oil, or ether extract, and the minerals, besides some albuminoids. In the outer layers removed during this process the concentration of phosphoric acid is greater than that of potash, although there is relatively more of both these constituents in the bran than in the polished grain. The nitrogen is more uniformly distributed.

5) No relation can at present be traced between the chemical composition and the accepted culinary properties of the different rices.

6) As regards the dietetics of rice the greater acceptability of highly milled rice is attained at considerable loss of mineral substances. The use of these products requires greater attention to the mode of preparation of rice for the table and more careful consideration of the remainder of the diet than was necessary in the days of more primitive milling processes.

142 - **Fertiliser Trials with "Tetraphosphate" in Piedmont Rice Fields, Italy.** — MARCARIELLI and NOVELLI, in *Il Giornale di Riscicoltura*, VIth Year, No. 21, pp. 321-327. Vercelli, Nov. 15, 1916.

Following the instructions of the Italian Ministry of Agriculture, Industry and Commerce, the writers have experimented on the effect of this new phosphatic product (1) in rice fields, that is to say, in extremely acid soils, very poor in lime.

The soil of the experimental field (Cascina Angossa, Vercelli Rice-Cultivation Station), which has been under rice for the last 5 years, is a fine particled sandy clay with deep permeable subsoil, rich in water, plentifully supplied with organic matter and, in view of preceding applications of fertiliser in considerable quantities, not devoid of mineral phosphates.

The preceding winter the whole rice field had received 3.5 quintals per hectare (2.79 cwt. per acre) of mineral superphosphate and a little farm-yard manure. The soil was therefore fertile at the moment of commencing the trials. The "tetraphosphate" was compared with superphosphate and ground phosphorite on 3 lots of 100 sq. metres for each fertiliser, one lot of 300 sq. m. serving as control. Towards the close of May, before

(1) See B. 1916, No. 1063.

(*td.*)



flooding the rice field, the ground was ploughed to a depth of 18 cm. and the weeds completely buried. There were then applied to each lot 5 kg. of "tetraphosphate" or of phosphorite, and 9.3 kg. of superphosphate in order to equalise the fertilising units of the 3 lots.

TABLE I. — *Percentage Composition of the Phosphatic Fertilisers under Trial.*

Fertiliser	Moisture	Total phosphoric anhydride	Phosphoric anhydride soluble in citric acid	Phosphoric anhydride soluble in citrate	Division with KAHL sieve
Tetraphosphate . . . . .	1.25 %	28.3 %	7.8 %	2.00 %	92.0 %
Ground phosphorite . . . . .	3.00	27.5	10.5	2.70	91.5
Superphosphate . . . . .	16.60	15.0	14.5	14.75	92.5

TABLE II. — *Yields per hectare (1) obtained in paddy fields with various phosphatic manures.*

Fertiliser tested	Phosphatic manure per hectare	Marketable grain (Paddy)	Residues of husking etc.	Straw
Tetraphosphate . . . . .	500 kg.	6 330 kg.	270 kg.	2 930 kg.
Ground phosphorite . . . . .	500	5 730 5 906	230 270	2 900 3 100
Superphosphate . . . . .	930	5 690	300	2 530

After spreading the manure the field was hoed and was not flooded before the 10th June. Thinning was carried out from the 15th to the 18th of June; sowing had taken place on the 15th April with selected paddy of the "Onsen" variety. When the plants had rooted, a top dressing was given on the 15th June of 200 kg. of calcium cyanamide per hectare and cultivation then proceeded in the usual way. The season was a fairly normal one. Harvesting was carried out on the 2nd and 3rd October. The composition of the fertilisers used and the results of the trials are given in the appended tables; they show that the tetraphosphate gave good results. However, the authors do not consider these results as sufficiently decisive and they propose continuing the experiments with the object of "distinguishing the possible basic or acid function of the various phosphatic fertilisers under trial from the specific function of each of them in relation to the lime or acid content of the soil" and in order to elucidate whether the presence of magnesium in the tetraphosphate (that employed contained 0.6 %) can have exerted a specific action.

(1) 100 kg. per hectare = 89.215 Cles per acre.

(1d.)

143- **Rice Production in Peru** (1). — *Commerce Reports*, No. 273, p. 677. Washington, D. C., November 20, 1916.

In two coast Departments of Peru (Lambayeque and La Libertad) the cultivation of rice claims the attention of the greater part of the inhabitants. The land is fertile, there is an abundance of water, and the climate is favourable to the production of rice.

Being so favoured by natural conditions the rice planters have not yet begun to fertilize their land, as is done in other rice-growing countries, but take advantage of the extensive areas to let part of their ground lie fallow. About 60 000 acres in these two Departments are cultivated in rice, giving an average yield of about 1 500 pounds of rice per acre. The West Coast Leader in a recent issue states that this yield could probably be doubled if the land were thoroughly fertilized.

Little change is noted in the production of rice from year to year. New implements for cultivating and thrashing the rice are now coming in use, however, and the crop of 1915-16 shows a slight increase over that of 1914-15. It is estimated that the total production of rice in Peru, including the yield from Provinces in which rice is cultivated as only one of several crops, will reach 40 000 metric tons in 1915-16. The quantity of Peruvian rice is said to be unexcelled, and it finds a market in other countries as well as at home. In 1913 Peru exported \$ 380 686 worth of rice and imported \$ 546 313 worth; in 1914 the exports amounted to \$ 305 480 and the imports to \$ 404 591.

144- **Variety Tests of Maize.** — HUTCHINSON C. B., EVANS A. R., HACKLEMAN T. C., and Mc DONALD E. M., in *University of Missouri Agricultural Experiment Station Bulletin* 143, pp. 56, Columbia, Missouri, July, 1916.

Variety tests of maize in Columbia and in various sections of the State, in order to ascertain the best varieties suited to the various conditions and

TABLE I.

Variety	Length of ears ins.	Circum- ference of ears ins.	Maturation	Time for complete maturity in days	Height of plants in feet	
Boone County White . .	10.5-11	7.5-8	medium late	120-125	8.5	leafy
St. Charles White. . .	9.5-10	7.25-7.5	late	125-130	8.5-9.5	leafy
Commercial White. . .	10-10.5	7.5-7.75	late	125-130	9.0	highest yielder of corn
Johnson County White	10-10.5	7.5-7.75	medium late	120-125	—	like Boone County white
Silvermine . . . . .	9-9.5	7.5-7.25	early	100-110	7.0	only fairly leafy
Reid's Yellow Dent. . .	10-10.5	7-7.5	medium early	115-120	8.0	medium leafy
Leaming . . . . .	10-10.5	7.5-7.75	medium late	120-125	8.0	—
St. Charles Yellow . .	10.5-11	7.25-7.75	late	125-130	—	very leafy
Cartner. . . . .	9-9.5	7.25-7.5	very late	130-135	tall.	fairly leafy
Cob Pipe or Collier . .	7-10	9-11	very late	135-140	very tall.	—
Bloody Butcher . . .	medium	cylindrical	medium late	120-125	8.5	leafy
Calico . . . . .	9-11	cylindrical	medium late	120-125	8.5	leafy

(1) See International Institute of Agriculture, Bureau of Statistics, *International Year-book of Agricultural Statistics*, 1913 and 1914, Rome, 1915.

TABLE II.

Soil and character	Order of varieties. Yields in bushels per acre						
	Commercial White	Reid's Yellow Dent	Leaming	Boone County White	St. Charles Yellow	St. Charles White	N. of Trials
<i>Black Prairies:</i> Uplands; mellow silt loam over clay.	I 43.07	II 41.76	III 41.04	IV 40.96	V 40.11	VI 39.58	89
<i>Level Prairies:</i> Silt loam over clay.	I 41.18	III 38.04	VI 36.02	II 39.08	V 36.69	IV 37.40	67
<i>Rolling Prairies:</i> Coarse loams over gritty clay.	I 43.09	II 41.29	IV 40.73	V 40.27	III 41.17	VI 39.70	20
<i>Gray Prairies:</i> Silt Loam to sandy loam over clay or sandy clay.	I 30.06	IV 25.09	V 25.01	II 25.95	VI 24.39	III 25.71	30
<i>Ozark Border;</i> Gravelly loam or silt loam over silty clay.	I 40.02	IV 36.26	VI 35.27	II 37.70	III 36.70	V 35.90	59
<i>Ozark Uplands:</i> Gravelly and stony loams over clay.	I 30.53	V 27.13	VI 24.74	III 28.91	IV 28.48	II 29.81	37
<i>Missouri Bottom lands:</i> Loams and sandy loams over loam.	I 51.92	V 46.21	IV 47.42	III 48.93	VI 44.18	II 50.18	13



soils of the State, and to disseminate the seed of the best varieties. The work done covers the period 1905-1914. The history and description of each variety is given together with an illustration. The following table gives a summary of the principal characters of the varieties (Table I).

The typical soils of Missouri are next discussed, and the yields obtained in the trials of the 6 leading varieties are given.

These data are condensed as follows (Table II).

These variety tests show that the leading varieties of white maize are Commercial White, Boone County White, and St. Charles White. The leading varieties of yellow corn are Reids' Yellow Dent, Leaming, Cartner, and St. Charles Yellow.

**145—Choice of Varieties and Seed Selection in Forage Crops.** — VIGGIANI D., in *Atti della Reale Accademia dei Georgofili di Firenze*, 163rd Year, No. 3, pp. 128-137. Florence, July 1916.

A summary of information and data obtained by the writer in the experimental fields of the "Vegni" Agricultural Institute (Arezzo, Italy) relating to spring, autumn and autumn-winter forage crops.

**SPRING FORAGE CROPS.** — The plants most commonly cultivated are crimson clover and vetches. In comparative trials in 1907-1908, the following varieties of crimson clover were examined: (a) early crimson ripening 5-6 days before the common clover; (b) late clover with white flowers ripening 7 days later; (c) extra late clover with red flowers ripening 10-12 days later. The yields of fresh forage were respectively 11.95 tons, 13.94 tons, 9.96 tons per acre, whereas the ordinary crimson clover in identical conditions scarcely gave 7.97 tons. These results show that it is profitable to grow successively maturing varieties on the same farm. In this way the drawback resulting from the use of clover cut too late, that is to say, when long, rough hairs are present on the calices of the flowers, is avoided. These form hard resistant masses in the intestine and are frequently capable of producing very serious inflammation. The Alexandrian clover, Moshawi variety, widely cultivated in Egypt, has proved resistant in the course of trials, to a minimum temperature of  $-4.5^{\circ}\text{C}$ , and has shown itself to have become extremely well adapted to the climate of Tuscany, where it gives a yield of 11.95 tons per acre.

With regard to field vetches, the following varieties have been tested:

*Vicia villosa*, 12.94 tons of fresh forage per acre — *V. narbonensis*, 23.9 tons per acre — *V. sativa* var. *alba*, 17.92 tons per acre — *V. macrocarpa*, 5.97 tons per acre — Common winter vetch (*V. sativa*), 12.74 tons per acre. As regards precocity, the Narbonne vetch (*V. narbonensis*) and the hairy vetch (*V. villosa*) are earlier than the remainder. It has also been remarked that the largest and heaviest seeds give the strongest plants.

**SUMMER FORAGE CROPS.** — The most commonly cultivated crop in this class is the small forage "Cinquantino" maize for which are employed the varieties cultivated for seed. The author, on the other hand, has compared the following varieties: Common yellow maize, 27.88 tons of fresh forage per acre. Caragua Horse-tooth maize, 39.83 tons per acre. The most profitable quantity of seed was 10.69 galls. per acre.

LATE AUTUMN FORAGE CROPS. — The commonest crop is rape, either cultivated alone or, more usually, along with oats, horse-beans, "Cinquantino" maize etc. The writer has compared the following varieties: Auvergne — White Norfolk — Red Norfolk — Val di Chiana — Pisa.

The "Auvergne" rape has: a piriform, flattened root; the neck very well developed and bluish red in colour; the foliage abundant.

The "white Norfolk" has a flattened spherical root, greenish white in colour, uniform, the neck thin, leaves large.

The "red Norfolk" has: a rounded root terminating in a pivot; the neck, very well developed, reddish; the chief veins also red.

The "Val di Chiana" has an irregularly cylindrical root very well developed, greenish white in colour.

The "Pisa" variety has a pivot shaped root and the neck pink.

The data collected have led to the conclusion that for earliness and yield "Val di Chiana" ranks first and "Pisa" second; then follow: "Norfolk white", "Norfolk red", and "Auvergne". The difference between the Italian and foreign varieties is so marked that there can be no hesitation in preferring the former. The writer has separated 7 varieties definitely distinct from those of the Val di Chiana variety; the study of the influence of size and colour of the seed has given the following results: the development of rape plants derived from big seeds is much superior to that of plants produced by average sized seeds, and still more superior to that of plants from small seed. No difference has been noticed between roots derived from dark seed and those derived from reddish seed.

146 — History, Cultivation and Improvement of *Lolium perenne* at Svalöf, Sweden. — WITTE HERNFRID, in *Sveriges Utsädesförenings Tidskrift*, Year XXVI, No. 5, pp. 195-205, 2 fig. Malmö, 1916.

*Lolium perenne* (Perennial rye grass), a native of Europe, N. Africa and the temperate regions of Asia, has been also imported into N. America and Australia. In Sweden, it grows wild as far as the 36th.<sup>o</sup> of latitude.

First cultivated in England towards the middle of the 17th. century, it first spread to Europe towards the end of the 18th. and beginning of the 19th. century. The exact date at which it was introduced into Scandinavia is unknown; some say in 1731, but it is only in the course of the last few decades that it has become distributed as an important forage plant in the South of Sweden.

*Lolium perenne* is well suited by the moist climate of Great Britain and Western Europe. In Sweden, it is especially adapted to localities where the early red Silesian clover is grown, the only leguminous plant (thanks to its earliness) with which it can be grown.

However, in those regions of Scandinavia where the latter half of spring is too hot or dry, *Lolium perenne* is already completely dried up and consequently of inferior nutritive value at the time of harvest, that is to say when the clover is in flower.

The data collected in Table I give an idea of the productivity of *Lolium perenne* compared with that of other forage grasses.

TABLE I. — *Yield per acre of certain forage grasses at Svalöf, during the period 1910-1916.*

	1st year		2nd year		Total	
	Fresh forage	Comparative index	Fresh forage	Comparative index	Fresh forage	Comparative index
<i>Lolium perenne</i> . . .	114.54 cwt.	100.0	64.04	100.0	178.58	100.0
Swedish Timothy . .	96.38	84.1	83.47	130.3	179.85	100.7
Danish Cocksfoot . .	121.15	105.8	117.40	183.3	238.55	133.6
Danish Tall Fescue .	155.56	135.8	122.50	191.3	278.06	155.7
French Rye Grass .	171.25	149.5	150.37	234.8	321.63	180.1
Danish Field-Brome .	165.99	144.9	—	—	—	—

The writer has carried out at Svalöf a series of comparative trials on various new varieties, such as "Sutton", "Evergreen", "Annual", "Dwarf perennial". These, generally speaking, are identical and do not differ from the common type.

There is, however, one exception in this respect: a variety from the coastal region of Norway (Faederen) which is characterised by its growth habit and precocity (it flowers some 10-12 days before the common varieties), but it is also more susceptible to the attack of *Puccinia coronata* var. *Lolii*.

As regards yield, the Norwegian type remains superior to native varieties in wet and cold years, but its yield is affected by drought.

*Lolium perenne* is not at all uniform in its characters, all these latter varying within fairly wide limits; such for instance are: length of culms — stooling capacity — resistance to cold and rust — shape of leaf — earliness. Among individuals belonging to the same crop there may be a difference of a fortnight in the time of flowering.

The types of *Lolium* to be sown with early red clovers should show the following characters:

- 1) High yield of forage, both first cut and aftermath.
- 2) Good yield of seed.
- 3) Resistance to low temperatures.
- 4) Resistance to rust.
- 5) The flowering phase should coincide with that of red clover (thus late flowering types)

The "*Svalöfs Viktoria*" variety, selected and improved at Svalöf, already largely fulfils these requirements. It is resistant to cold and rust, has a well developed leaf system and very robust culms, a late flowering period and a good yield.

TABLE II. — *Yield per acre of the variety "Svalöfs Viktoria" compared with the common variety of Lolium perenne.*

Varieties	1st year			2nd year	
	1st cut.	Aftermath	Total	Comparative index	
"Svalöfs Viktoria" .	134.37 cwt.	22.30 cwt.	152.69 cwt.	113.5	71.68 cwt.
Common type . . . .	111.27	23.26	134.53	100.0	54.16



As regards yield of forage, "Svalöfs Viktoria" thus yielded 13.5 % more the 1st year and 30 % more the 2nd year. But the most striking character is the delay in flowering (10 to 12 days after the common variety) so that at the time of cutting when the red clover is in flower, the plant is not yet dry, but green and luxuriant, even when the spring is a hot, dry one.

147 - **The Possibilities of Fodder Plants in South-Africa.** — POLE EVANS I. B., in *The Agricultural Journal of South Africa*, Vol. III, No. 17, pp. 113-135; Johannesburg, May 1916.

The little investigation work that has been done in the scientific study of the fodder plants of South Africa is sufficient to show that it would more than repay any outlay spent upon it. Not only could many of these plants be considerably improved by cultivation, but many of them are rapidly disappearing.

Many of them are far better able to withstand the vagaries of the South African climate than the majority of imported species. Although we know that some veld plants are eaten by cattle, others by sheep and another class by horses, we have, comparatively speaking, no definite data as to which plants are relished most by the different kinds of stock or which of these plants are the most nutritious.

The distribution of some of the best known Fodder Plants in South Africa is the following :

*Panicum coloratum*. — Said to be the sweetest of all the native grasses in British Bechuanaland and very fattening.

*Panicum laevifolium*. — An annual sweet grass, one of our most valuable hay and pasture grasses, fairly widely distributed in the Transvaal and also reported from the O. F. S. and Natal.

*Trifolium africanum*. — A native clover very hardy and of excellent feeding value, equaling lucerne. Common in the Transvaal-Bethal, Pretoria, Lydenburg, Witwatersrand District, etc.; also in the O. F. S., Natal and Cape Province.

*Anthephora pubescens*. — Considered one of the best pasture grasses in parts of Bechuanaland where it grows.

*Chrysopogon serrulatus*. — A grass much relished by stock in British Bechuanaland.

*Tricholaene rosea*. — "Natal Red Top". Annual grass. Widely distributed throughout the Union.

*Aristida obtusa* and spp. — Toa grasses of the Kalahari regions, where they form the principal fodder for stock; rather coarse and wiry when it gets old.

*Eragrostis superba*. — Said to be a favourite and good fodder grass for cattle. Also other species of *Eragrostis*.

*Chloris virgata*. — Old lands grass, sweet grass; makes excellent hay. An annual.

*Chloris gayana*. — "Rhodes grass". Perennial; excellent pasture grass.

*Ipomoea crassipes*. — Reported from Sprigbok Flats as being much liked by stock. Analysed by Government Chemist — general feeding value good.

*Cababa juncea*. — From Springbok flats. Analysed by Government Chemist — feeding value good.

*Merremia palmata*. — From Pietersburg, said to be greedily eaten by ostriches and by cattle and sheep. Natives say that young stock fed on this do well and require no water. Farmers round Pietersburg who go in for catching wild ostriches say that to be successful with them they should be fed, for some time, entirely on this plant.

*Pennisetum purpureum*. — Elephant grass or Napier Fodder. — A native of Tropical Africa.

*Pennisetum longistylum*. — Kikuyu grass. — Also from tropical Africa ; spreads rapidly and makes a mass of succulent herbage ; eagerly eaten by stock.

*Portulacaria afra*. — The Spekboom. An indigenous plant found in the Eastern Karoo, one of the most drought resistant and at the same time nourishing plants to be found in the world.

*Euphorbia cervicornis*. — The Olifants Melkbos, a plant highly prized by the transport riders in Namaqualand and several other valuable fodder plants which would often repay attention and cultivation.

148—The “Water Pansy” or “Madagascar Pansy” (*Pistia aegyptiaca*) in the Island of Reunion : Composition and Uses. — DE VILLÈLE A., in *Revue agricole de l'Île de la Réunion*, Series II, Year IV, No. 8, pp. 205-308. St. Denis (Réunion), 1916.

Towards 1865 an aquatic plant called “water pansy” or “Madagascar pansy” (*Pistia aegyptiaca* Schleid = *P. Stratiotes* L.) was introduced

*Production per hectare (2.47 acres) and chemical composition of Pistia aegyptiaca.*

	Leaves	Roots	Total
<i>Production of green matter per hectare. . . .</i>	72 105 kg	22 895 kg	90 000 kg
<i>Constituents of green matter :</i>			
Water . . . . .	90.15 %	80 %	—
Organic matter . . . . .	7.50	12.31	—
Mineral matter . . . . .	2.35	7.69	—
<i>Constituents of dry matter :</i>			
Nitrogen . . . . .	2.39 %	2.27 %	—
<i>Constituents of ash :</i>			
Phosphoric anhydride . . . . .	3.63 %	1.81 %	—
Potash . . . . .	15.09	9.10	—
Lime . . . . .	4.69	1.61	—
<i>Production of fertilising matter per hectare :</i>			
Dry matter . . . . .	7 123 kg	4 579 kg	11 702 kg
Nitrogen . . . . .	170.23	99.36	269.59
Phosphoric anhydride . . . . .	67.45	32.28	99.73
Potash . . . . .	281.35	165.80	447.15
Lime . . . . .	87.54	28.43	115.97
<i>Nutritive constituents :</i>			
Water . . . . .	90.12 %	—	—
Ash . . . . .	2.58	—	—
Fibre . . . . .	3.14	—	—
N. free extract . . . . .	2.52	—	—
Fats . . . . .	0.16	—	—
Crude protein . . . . .	1.48	—	—

into Réunion and was allowed to spread in the " Etang de St. Paul " without being utilised. In view of its ultimate utilisation as a feed for livestock or as a manure, analyses were made at the Laboratory of the Mauritius Dept. of Agriculture which gave the data appended in the above table.

With regard to " water pansy " as a supplementary feed it must be used when the plant is younger and its fibre content smaller than that at the moment when the analyses were made.

The yield of manure afforded by *Pistia* represents a quantity of nitrogen and potash sufficient to be of decided value to the crops on which it is employed.

149- **Wild Plants of Queensland (Australia) which can be Used for the Extraction of Textile Fibres and for the Manufacture of Paper.** — *Queensland Agricultural Journal*, Vol. VI, Part, 4, pp. 235-238, 1 fig. Brisbane, October, 1916.

FIBRE CROPS

At the Agricultural Exhibition held at Bowen Park, Queensland, in 1916, MR J. CAMPBELL of Gossypium Park, Kamma, near Cairns, exhibited a collection of : textile fibre and their manufactured products ; baskets and paper made by the natives from the fibre of plants mostly found growing in Queensland in a wild state. The most remarkable of these products were the following :

#### A. — TEXTILE FIBRES.

Jute (*Triumfetta* sp.) and Chinese Burr (*Urena* sp.). Herbaceous plants which can become the source of a most important industry. For the dyed fibre he exhibited, Mr Campbell was offered £ 35 per ton, and it cost less than £ 20 to produce.

Rosella (*Hibiscus Sabdariffa*) fibre — The fruit of the rosella is worth 2d. to 3d. per lb. for jam, and when the plants are rooted up they yield 7 per cent of fibre of which the present value is £ 40 per ton. Thus the fruit will be nearly all profit.

" *White Cotton* " (*Hibiscus*) fibre. — A wild tree which is very common in Queensland from Tweeds Head to Cape York. The fibre is worth £ 20 per ton and a man can prepare 1 cwt a day. Cord is made from the fibre.

" *QueenslandHemp* " (*Sida retusa*) fibre, pine apple and *Carica papaya* fibre.

#### B. — PAPER PULP.

Pulp made from Blady grass, or Lalang, (*Imperata arundinacea*) — In Queensland this plant grows wild and produces 4 tons to the acre on good land. Four tons will produce (according to its dryness) 1 1/2 to 2 tons of pulp and this is worth £ 8 per ton.

*Triumfetta* and *Urena* Pulp. — The whole plant can be converted into pulp, but if the fibre is taken, the balance can be made into pulp. Three tons will make 1 ton of pulp.

*Sida retusa* Pulp — This makes a very high class paper, suitable for bank notes and legal documents.



*Pulp from Cane Tops.* — makes excellent paper, especially blotting-paper.

*Pulp from Cane Top.* — Makes excellent paper, especially blotting-paper.

*Sugar Cane Megass Pulp.* — As fuel megass is worth 5s. per ton, but for paper making it fetches about 12s. 6d. to 15s. a ton delivered.

*Banana Pulp.* — After fruit-bearing, the whole plant can be manufactured into paper pulp. The paper produced is of very high quality. It takes 5 tons of banana stems and leaves to make 1 ton of pulp which is worth £ 10.

*Pulp from pineapples, Pandanus sp.* (which yields  $\frac{1}{4}$  of its green weight of high-class pulp), *Hibiscus sp.*, Bamboo.

RUBBER,  
GUM AND RESIN  
PLANTS

150 - **Rubber Cultivation in Siam.** — HANSEN, C. C., in *Commerce Reports*, No. 279, p. 776. Washington, D. C., November 27, 1916.

Hitherto Siam has not acquired any distinction as a rubber-growing country, and during the last five years the export of this product through the port of Bangkok has been comparatively small. Such shipments are listed by the customs under the head of "Rubber and rubber substitutes", the exports under this classification amounting to 142 304 pounds, valued at \$ 18 533, for the fiscal year 1912; 229 240 pounds, value \$ 32 548, for 1913; 207 025 pounds, value \$ 33 431 for 1914, 125 764 pounds, value \$ 15 533, for 1915; and 187 980 pounds, value \$ 11 055 for 1916.

The only rubber plantation of any importance in southern Siam is located at Chantaboon and consists of 25 000 trees, planted about 6 years ago, of which 20 000 trees are now ready for tapping. Considerable quantities of rubber however, are said to come from northern Siam as the product of rubber-yielding trees in the jungle.

In the Siamese Malay States some attention has been given to rubber cultivation in the districts of Trang and Setul. Reliable information is not obtainable here, but it is said that the output of rubber has been insignificant so far in these Provinces.

SUGAR CROPS

151 - **Correlations Between Morphological Characters and the Saccharine Content of Sugar Beets.** — PRITCHARD, FREDERICK J., in *American Journal of Botany*, Vol. III, No. 7, pp. 361-376 + 8 fig. Lancaster, Pa., July 1916.

Cross sections of the sugar beet roots show a concentric appearance resembling the annual rings of a tree; wood zones alternate with zones of parenchyma. The former are the richer in sugar (average difference in favour of wood zones 2.6 per cent). As small roots usually have as many zones of wood as large roots, and relatively less parenchyma, they should contain the higher average percentage of sugar. A number of experiments and analyses have shown that this is the fact, and that the correlation between percentage of sugar and size of root is negative; the correlation index is - 0.258. The above-mentioned relationship and its nature are shown by numerous tables and graphs. The correlation between percentage and quantity of sugar in beet roots of equal weight is nearly perfect: 0.93 - 0.99. It is known that the correlation may go from - 1 to 1. There is, however, apparently no correlation in beet roots of miscellaneous weights.

TABLE I. — *Correlation between: Shape of Root and Crown and: Weight of Root, Quantity of Sugar per Root and Percentage of Sugar.*

	Average weight of root in Grams.	Average Quantity of sugar per root	Percentage of sugar in Beet
<i>Shape of root:</i>			
pyriform . . . . .	443 g	$78.28 \pm 0.35$ g	$17.67 \pm 0.02$ %
conical . . . . .	452	$80.18 \pm 0.44$	$17.75 \pm 0.03$
napiform . . . . .	458	$80.70 \pm 0.85$	$17.63 \pm 0.06$
fusiform . . . . .	510	$88.24 \pm 2.07$	$17.30 \pm 0.12$
cylindrical . . . . .	590	$99.88 \pm 1.92$	$16.93 \pm 0.14$
<i>Shape of Crown:</i>			
flat . . . . .	494	$87.17 \pm 0.55$	$17.63 \pm 0.04$
rounded . . . . .	438	$77.63 \pm 0.30$	$17.74 \pm 0.02$
conical . . . . .	433	$74.83 \pm 0.94$	$17.30 \pm 0.06$

TABLE II — *Correlations between Depth of Root Furrows, Growing Habit and Dimension of Leaves and: Weight of Root, Quantity of Sugar per Root and Percentage of Sugar in Beet.*

	Average weight of root	Average quantity of sugar per root	Percentage of sugar in beet	
<i>Depth of root furrows:</i>				
medium . . . . .	442 g	78.36 ± 0.43 g	17.71 ± 0.03 %	
shallow . . . . .	445	78.10 ± 0.48	17.55 ± 0.03	
deep . . . . .	468	82.91 ± 0.44	17.72 ± 0.03	
<i>Growing Habit of Foliage:</i>				
erect . . . . .	468	81.33 ± 0.67	17.37 ± 0.04	
semi-erect . . . . .	445	78.98 ± 0.29	17.74 ± 0.02	
flat . . . . .	482	85.03 ± 0.89	17.65 ± 0.04	
<i>Leaf dimension:</i>				
<i>Length</i> .	short . . . . .	411	72.78 ± 0.62	17.69 ± 0.05
	medium . . . . .	450	79.60 ± 0.30	17.70 ± 0.02
	long . . . . .	497	87.05 ± 0.72	17.50 ± 0.05
<i>Breadth</i> .	narrow . . . . .	455	80.52 ± 1.41	17.70 ± 0.12
	medium . . . . .	449	79.30 ± 0.26	17.68 ± 0.02
	wide . . . . .	605	104.75 ± 2.28	17.31 ± 0.13

TABLE III — *Correlations between : Petiole Dimension, and Depth of Petiole Groove on the One Hand, and Weight of Root, Quantity of Sugar per Root and Percentage of Sugar in the Beet on the Other.*

		Average Weight of Root	Average Quantity of sugar per Root	Percentage of sugar in the Beet
<i>Petiole dimensions :</i>				
<i>length . . .</i>	{ short . . . . .	439 g	77.55 g	17.67 %
	{ medium . . . . .	445	79.13	17.80
	{ long . . . . .	459	80.40	17.50
<i>breadth . . .</i>	{ narrow . . . . .	420	74.02	17.61
	{ medium . . . . .	452	80.20	17.75
	{ wide . . . . .	525	91.50	17.43
<i>Depth of petiole groove :</i>				
shallow . . . . .		419	74.12	17.67
medium . . . . .		444	78.51	17.70
deep . . . . .		479	84.61	17.66

A distinctly positive correlation (0.92) exists between the size (weight) of the root and the quantity of sugar it contains. The shape of the beet root also affects the sugar content. The roots may be conical, pyriform, napiform, fusiform and cylindrical, the latter are lowest in percentage, but highest in quantity of sugar.

Beets having flat crowns are heaviest and contain a slightly higher percentage of sugar than those possessing conical crowns which are usually smaller. The conical crown, therefore appears to be a detrimental character, as it is correlated with both low percentage and a small quantity of sugar. Table I gives data on this subject.

There is a positive correlation between the depth of the root-furrows and the sugar percentage.

As is shown by Table III. Three types of foliage are found in the beet : erect, semi-erect and flat. The flat, or rosette type, is correlated with the largest quantity of sugar per root, while the maximum percentage is found in the semi-erect type, the erect type being always inferior to the others. (see Table II). Positive correlation also exists between leaf dimension and root weight, and consequently between the size of the leaf and the quantity of sugar per root. The form and structure of the leaves and petioles are more or less in correlation with the sugar percentage. Beets having smooth leaves are richer in sugar than those with wrinkled, irregularly shaped foliage. Fine, pliable leaf texture is correlated with large roots, and therefore with a greater quantity of sugar.

On the other hand, the colour of the leaf and the type of leaf margin :



TABLE IV. — *Correlations between Root Types and Sugar Percentages (number of roots with a given percentage of sugar).*

	Percentage of sugar																	No. of roots per type	Average sugar percentage per type	
	13	13.5	14	14.5	15	15.5	16	16.5	17	17.5	18	18.5	19	19.5	20	20.5	21	21.5	22	
Type A . . . . . roots	1	1	1	2	3	5	9	12	12	6	11	5	6	4	2				80	17.07 %
Type B . . . . . roots			3	1	3	8	6	13	14	11	10	5	6	2	3			1	86	17.63
Type C . . . . . roots					2	4	3	9	11	11	12	13	7	8	4	1	2	1	88	17.93

TABLE V. — *Correlations between Root Types and Quantity of Sugar per Root (number of roots containing a given quantity of sugar).*

	Average of sugar																									No. of roots	Average quantity of sugar per root	
	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100	105	110	115	120	125	130	135	140	145	150		
Type A . . . . . roots	1	1	1	2		5	7	8	7	9	10	7	2	5	5	3	1	1	1	1	1	1	1	1	1	1	80	74.68 g
Type B . . . . . roots		1			2	5	5	9	8	5	4	6	5	7	7	1	10	3	1	3			3				86	87.26
Type C . . . . . roots				3	4	2	1	2	5	7	4	9	11	7	7	6	7	3	3	2	3	2					88	85.51

undulate, sinuate or curly, are of no correlative importance. The dimension of the petiole has no correlation with the percentage of sugar in the root, the total sugar, however, increases with the size of the petioles which is specially marked in connection with the breadth. The increased depth of the groove on the upper surface of the petiole is also connected with a large quantity of sugar, as is shown by Table III.

By aid of the foregoing data, the writer distinguishes 3 types of sugar beets: A, B and C which have been formed by combining in A, characters correlated with relatively low sugar production, and in B and C, characters correlated with both a large quantity and a relatively high percentage of sugar.

Type A. crown conical, root furrows shallow.

Type B. crown flat or rounded, root furrows deep, leaf surface smooth, thin and pliable, petiole groove deep.

Type C. identical with B except in having a pyriform root (in B, the root is conical).

The writer divided 254 beetroots, according to their different characteristics, into 3 lots, 80 having the characters of type A, 86 those of type B and 88 those of type C. The correlations between these types and the sugar percentage are shown in Table IV, and the correlations between the types and the Quantity of sugar per root are given in Table V.

The number of individuals in each group is not large, but the distribution is fairly regular. B and C exceed A by several times the probable error, both in percentage and quantity of sugar per root. If the 2 other characters, wrinkled leaf surface and shallow petiole groove had been included in type A, the contrast between it and the other types might have been still greater.

It is possible, that if certain other characters, such as number of wood-rings, size, shape and number of bundles within the wood-ring, number of leaf-circles, (spiral turns), total number of leaves, and nature of veining had been included in the investigation, greater differences would have been exhibited between the types, and the work of selection would have been facilitated by the discovery of other clear, well-marked distinct correlations.

**152—Manuring of Sugar Cane in Java: Comparative Results with Calcium Cyanamide and Sulphate of Ammonia.**—GEERTS, J. M., in *Mededeelingen van het Proefstation voor de Java Suiker-industrie, Archief voor de Suikerindustrie in Nederlandsch Indië*, Year XXIV, No. 44. Soerabaja, 1916.

The results of a series of 78 trials carried out from 1905 to 1914 in order to compare the action of calcium cyanamide and sulphate of ammonia on sugar cane in Java.

In 59 cases, sulphate of ammonia gave better results both as regards yield of cane and yield of sugar. The surplus given by sulphate of ammonia over calcium cyanamide is calculated at 2.5 % for the yield of cane and 2 % for that of sugar. The results have shown that in general, sulphate of ammonia gave better results than cyanamide both in light and heavy soils; however, one has the impression that cyanamide gives better results in light than in heavy soils.

The results of 16 trials show that partial application of cyanamide before planting is preferable to an exclusive application after planting ; further, 13 other trials have shown the advantages of an application at 3 or 4 separate times, of which the first should be before planting ; when it is given at least one week before planting and the subsequent applications are not allowed to come in contact with the plants, the cyanamide is transformed before reaching the rootlets and there is scarcely any danger of an injurious action. Partial substitution of sulphate of ammonia by cyanamide is more certain than complete substitution, but the cyanamide should always be applied before the sulphate of ammonia.

Finally, cyanamide has no influence on the maturation of the cane. The writer recommends further trials on the same subject.

153 - **Experiments on the Drying of Tobacco in Java.** — DE VRIES, O., in *Mededeelingen van het Proefstation voor Vorstenlandsche Tabak*, No. XXV, Semarang, 1916.

The writer has experimented with various methods of drying tobacco, in the drying sheds in common use in Java, and in a little warmed and ventilated, brick building, where temperature and humidity were under continual control.

Two phases are distinguished in the drying process : the 1st is marked by the transition of the green colour of the leaves to brown, lasting 7 to 10 days ; the 2nd is characterised chiefly by the drying of the midrib and by the completion of the drying of the brown leaves. During the 1st phase, the tobacco is very sensitive to slight changes of temperature. The writer experimented between 26 and 30° C. and found that a difference of 2 to 3 degrees had considerable influence on the drying. The relative humidity of the atmosphere has also some influence. During this phase ventilation hardly affects the drying process. Rapid drying gives a better quality tobacco, with thin pliable leaf and generally lighter colour.

Among the drawbacks of rapid drying are the fact that the tobacco becomes more hygroscopic and is more liable to lesions during piling preparation to fermentation. But by careful handling of the stacks during packing of the leaves these injuries may be avoided. On the other hand, slow drying more easily gives rise to rotting of the tobacco or at any rate to the formation of mould which spoils the leaves.

\* During the 2nd stage, the greater or less speed of drying made little difference, though leaves dried rapidly are lighter in colour. By speeding up drying by means of heating the sheds, the 2nd phase may be shortened by 4 to 5 days.

Generally speaking, rapid drying gives certain advantages, and the writer recommends further experiment.

The experiments on artificial drying have shown this method to have many advantages for the quality of the finished product. Tobaccos obtained in this way were submitted to European experts and they were unanimous in proclaiming the superior quality of the tobacco treated in this way.

Hitherto, drying during the 1st phase has had hardly any attention from planters, but the writer recommends more care during this stage.

STIMULANT,  
AROMATIC,  
NARCOTIC  
AND MEDICINAL  
PLANTS



He already thinks to have obtained an improvement by regulating the distances between the poles to which the strings are attached which support the leaves in the sheds.

154 - **Results of the Inter-Ministerial Conference in 1915 on the Production and Improvement of Medicinal Plants in Russia.** — Сапипперовъ Ф. (SAZYPEROV, F.), in *Труды Бюро по прикладной Ботаникѣ* (*Bulletin of Applied Botany*), Year IX, № 7 (92), pp. 385-387. Petrograd, July 1916.

This Conference (1), summoned by the Department of Agriculture in order to discuss the question of rendering the Russian Chemical Industry independent of foreign imports, was supported not only by the representatives of the various Government Departments but also by the representatives of science and of the most important commercial houses dealing with medicinal plants and their seeds. The following is a summary of the recommendations and decisions adopted:

A. — CULTIVATION AND GATHERING OF WILD MEDICINAL PLANTS.

1) It is desirable: a) to intensify the collection of the following plants and also the methods of preparation:

*Adonis vernalis* L. = False Hellebore

*Tussilago Farfara* L. = Coltsfoot (Leaves).

*Valeriana officinalis* = True Valerian.

b) to study the properties of valerian, gathered both in high and low situations.

2) It is recommended that the following plants should be gathered and the methods of preparation improved:

*Achillea Millefolium* L. = Yarrow (leaves and seeds).

*Acorus Calamus* L. = Sweet flag (rhizome), for export.

*Arctostaphylos Uva-ursi* Spreng. = Bear-berry (leaves).

*Cannabis sativa* L. var. *indica* = Indian Hemp (seeds).

*Centaurea Jacea* L. = Centaury (herb).

*Colchicum autumnale* L. = Meadow saffron (seeds).

*Lactuca virosa* L. = Field Lettuce (seeds).

*Matricaria Chamomilla* L. = Wild Camomile (flowers).

*Orchis Morio* L. = Green-veined Orchis (tubers).

*Secale cornutum*. = Ergot of Rye

*Veratrum album* L. (rhizome).

*Verbascum Thapsus* L. = Aaron's rod (flowers).

3) Methods of collecting and drying the following plants should be improved:

*Brassica nigra* Koch. = Black mustard (seeds).

*Aspidium Filix mas* Sw. = Male fern (rhizome).

(1) See B. 1916, No. 651. — See also 2 publications of the Dept. of Agriculture: 1) Монтеверде Н. (MONTEVERDE N.) *Порайонный обзор лекарственных растений въ Европейской Россіи, Кавказа и Туркестана*. (Regional review of the medicinal plants in European Russia, the Caucasus and Turkestan) Juriev, 1915 — 2) Комаровъ Б. (KOMAROV, V.) *Сборъ, сушка и разведение лекарственных растений въ Россіи* (Cultivation, harvesting and drying of medicinal plants in Russia), 1915. (Ed.)

*Hyoscyamus niger* L. = Henbane (leaves).

*Laurus nobilis* L. = Laurel.

*Lycopodium clavatum* L. = Common Club-moss (spores).

*Melilotus officinalis* Lam. = Melilot (herb).

*Menyanthes trifolium* L. = Bog-bean (leaves).

*Taraxacum officinale* Weber. = Dandelion (leaves and roots).

4) For the following plants, the quantities already gathered must suffice:

*Artemisia Absinthium* L. = Wormwood (herb).

*Asperula odorata* L. = Woodruff.

*Cetraria islandica* L. = Iceland Lichen.

*Conium maculatum* L. = Hemlock.

*Ephedra vulgaris* Rich. (= *E. distachya* L.) = herb.

*Fragaria vesca* L. = Strawberry.

*Juniperus communis* L. = Juniper.

*Nigella sativa* L.

*Polyporus officinalis* Fries (= *P. Laricis* Duby).

*Punica granatum* L. = Pomegranate bark.

*Rhamnus Frangula* L. = Berry-bearing Alder.

*Tilia* sp. = Lime.

*Vaccinium Myrtillus* L. = Whortleberry.

*Veratrum album* L. = Sabadilla.

5) The following plants, not yet included in the Russian pharmacopeia, should be studied:

*Matricaria discoidea* D. C. = Rayless Camomile.

*Polygonum Hydropiper* L. = Water Pepper.

*Verbascum thapsiforme* = Mullein.

6) Attention should be paid to the collection of gum from species of *Ferula* (*F. Asafoetida* L., *F. galbaniflua* Boiss.) and the gathering of lilies of the valley (*Convallaria majalis*) for sale in the fresh state is also recommended.

#### B. — CULTIVATED MEDICINAL PLANTS

1) The cultivation of the following plants is regarded as necessary:

*Aconitum Napellus* L. = Monkshood.

*Althaea officinalis* L. = Marsh Mallow.

*Anthemis nobilis* L. = Camomile.

*Archangelica officinalis* Hoffm. = Gard. Angelica.

*Arnica montana* L. = Mountain Arnica.

*Atropa Belladonna* L. = Deadly Nightshade.

*Carum Carvi* L. = Carraway.

*Cochlearia officinalis* L. = Scurvy Grass.

*Chrysanthemum cinerariaefolium* Vis. = Dalmatian Pyrethrum.

*Digitalis purpurea* L. = Foxglove.

*Eucalyptus* spp.

*Erythraea Centaurium* Pers. = Centaury.

*Foeniculum officinale* All. = Fennel.

*Gentiana lutea* L. = Gentian.

*Glycyrrhiza uralensis* Fisch. = Liquorice.  
*Hydrastis canadensis* L. = Golden Seal.  
*Iris germanica* L.  
*Iris florentina* L.  
*Laurus nobilis* L. = Laurel.  
*Lavandula officinalis* Chaix = Lavender.  
*Matricaria Chamomilla* L. = Wild Camomile.  
*Mentha piperita* L. = Peppermint.  
*Mentha crispa* L. = Spearmint.  
*Pimpinella Anisum* L. = Burnet Saxifrage.  
*Rheum palmatum* L. = Rhubarb.  
*Ricinus communis* L. = Castor-oil Plant.  
*Rosa* spp.  
*Rosmarinus officinalis* L. = Rosemary.  
*Saponaria officinalis* L. = Soapwort.  
*Sinapis juncea* L. (= *Brassica juncea* Coss.).  
*Thymus vulgaris* L. = Thyme.  
*Trigonella Foenum graecum* L. = Fenugreek.  
*Valeriana officinalis* L. = True Valerian.  
*Verbascum thapsiforme* Schrad. = Mullein.  
*Verbascum phlomoides* L. = Mullein.

2) The cultivation for medicinal purposes is advocated of :

*Artemisia Dracunculus* L. = Wormwood.  
*Bidens tripartita* L. = Trifid Bur-Marigold.  
*Capsicum annum* L. = Cayenne.  
*Coriandrum sativum* L. = Coriander.  
*Crocus sativus* L. = Crocus.  
*Hyoscyamus niger* L. = Henbane.  
*Levisticum officinale* Koch. = Lovage.  
*Majorana hortensis* Moench. (= *Origanum Majorana* L.).  
*Paeonia officinalis* L. = Peony.  
*Papaver somniferum* L. = White. or gard. Poppy.  
*Salvia officinalis* L. = Sage.

3) The Commission considers it necessary to carry out experiments with the following plants :

*Colchicum autumnale* and neighbouring species.  
*Convallaria majalis* = Lily of the Valley (to determine the properties this species acquires under cultivation).  
*Digitalis* sp. = Various species of foxglove.  
*Polygala Senega* T. = Senega.  
*Rhamnus Purshiana* D. C. = Cascara sagrada or sacred bark.

155 - "Jaboticaba de cipo" (*Chondodendron platyphyllum*) a Wild Brazilian Fructiferous and Medicinal Plant. — PECKOLT GUSTAVE, in *Chacaras e Quintaes*, Vol. 14, No. 5. pp. 821-823. São Paulo, Nov. 15, 1916.

The writer has identified the plant called in Brazil "Jaboticaba de cipo", "Abutua legitima", "Parreira brava", "Parreira do matto", "Uva do matto", as *Chondodendron platyphyllum*. It is a menispermic,



sarmentous, climbing, monœcious plant, very common around Rio de Janeiro, wild in the States of Rio de Janeiro, Espírito Santo et Minas where it is particularly fond of the shade and dampness of the woods. The fruits form large clusters with black or purplish red grapes, from 20 to 25 mms. in length and about 17 mms. in cross section, containing a large seed. The pulp has an acid sweet taste resembling that of the grape. In 100 grams of fresh pulp, the writer has found :

Water . . . . .	84.583 gr.
Fats . . . . .	0.308
Colouring matter . . . . .	2.273
Glucose . . . . .	3.430
Tartaric acid . . . . .	0.357
Malic acid, pectine, gums etc. . . . .	4.331
Albuminoids . . . . .	1.013
Ash . . . . .	1.480

In the State of Rio de Janeiro, this plant flowers in January and gives ripe fruit from June to August; in that of Minas, it flowers in April and ripens in September.

The fruits keep for a long time. They are eaten raw and various cakes are prepared from them: their juice, fermented, and with the addition of 3 to 4 % sugar, makes a good wine. A dark red colouring matter is also extracted.

The root of "Jaboticaba" has long been used as a popular medicine in Brazil, serving as a tonic, diuretic and febrifuge. These properties have been confirmed by various European scientists (WIGGERS, 1838; VITALI, 1857), but the root is still very little employed in official medicine.

156 - Experiments with New Grape Stocks at the Montpellier National School of Agriculture, France. — RAVAZ, L., in *Le Progrès agricole et viticole*, 33rd Year, No. 45, pp. 437-442. Montpellier, Nov. 5, 1916.

VINE GROWING

With the object of experimenting with new stocks the writer, in 1913, established a new experimental field at the Montpellier Agricultural School. The soil contained 34 % of lime, was fairly homogenous and rather on the clayey side.

Chlorosis occurs in spring in varying degrees among the different varieties but is usually without importance for "Riparia".

The results are given in the appended Tables which give 3 kinds of information :

1) the average production per stock ; 2) the weight of the shoots, also per stock, which gives a measure of the vigour of the graft ; 3) the ratio  $\frac{F}{V}$ , F representing production and V the weight of the shoots.

This ratio also serves as a measure of the fertility of the subject ; formation of fruit etc. The vines under observation were 2 year-old grafts.

REMARKS. — *Riparia Gloire* and *Rupestris du Lot* serve as standards of comparison. The former remained low.

*New Grape Stocks Tested at the Montpellier National School of Agriculture.*

## I. SCION : ARAMON.

Nos of the rows	Stocks	F Average weight of grapes per stock	V Average weight of shoots per stock	$\frac{F}{V}$
1	Riparia Gloire . . . . .	916 g	299 g	3.158
2	Riparia Gloire . . . . .	700	325	2.153
3	Rupestris du Lot . . . . .	1 283	683	1.878
4	Rupestris du Lot . . . . .	2 775	875	3.171
5	Monticola . . . . .	450	358	1.256
6	Cordifolia . . . . .	1 958	616	3.191
7	Rubra . . . . .	0	0	0
8	Candicans . . . . .	2 350	370	6.351
9	Berlandieri (École de Montpellier) . . . . .	2 200	491	4.480
10	Berlandieri RICHTER . . . . .	2 820	630	4.476
11	Cinerea . . . . .	1 150	290	3.965
12	3309 (Riparia-Rupestris) . . . . .	1 825	650	2.807
13	3306 (Riparia-Rupestris) . . . . .	3 896	850	4.583
14	Rubra-Rupestris 5-2 RAVAZ . . . . .	1 566	416	3.764
15	216-3 (Candicans Riparia-Rupestris) . . . . .	3 120	600	5.200
16	106-8 (Cordifolia Riparia-Rupestris) . . . . .	100	233	4.291
17	18 804 (Riparia-Monticola) . . . . .	2 216	700	3.165
18	1 R. (Riparia-Monticola) . . . . .	1 350	190	7.105
19	2 R. (Riparia-Monticola) . . . . .	1 100	316	3.481
20	Cordifolia-Rupestris No. 1 de GRASSET . . . . .	775	425	1.823
21	Rupestris-Rubra 5-1 RAVAZ . . . . .	2 260	460	4.913
22	333 (Cabernet Berlandieri) . . . . .	1 750	600	2.916
23	41 B (Chasselas Berlandieri) . . . . .	2 850	566	5.035
24	Rupestris du Lot renversé . . . . .	833	180	4.627

*Rupestris du Lot*, in row 3, was planted in the usual manner ; in row 4, the plants were placed on flat stones in order to force the roots to take a horizontal direction. The result of this was an important increase in growth and fructification.

*Vitis Monticola* is always remarkable for its high resistance to chlorosis ; it is incontestably superior to *V. Berlandieri* : unfortunately it lacks a little vigour and seems especially sensitive to drought.

*V. Cordifolia* leaves something to be desired on account of chlorosis.

*V. Rubra* died of chlorosis.

*V. Candicans* did not do very well either.

*New Stocks tested at the Montpellier National School of Agriculture*  
 II. Scion : ARAMON.

Nos of the rows	Stocks	F Average weight of grapes per stock	V Average weight of shoots per stock	$\frac{F}{V}$
1	33 E. M. (Riparia Berlandieri) . . . . .	1 720 g	533 g	3.227
2	34 E. M. (Riparia Berlandieri) . . . . .	1 550	390	3.974
3	420 A. (Berlandieri Riparia) . . . . .	1 320	516	2.558
4	161-49 (Berlandieri Riparia) . . . . .	1 075	387	2.777
5	(Rupestris Berlandieri École) P. D. 5 . . . . .	1 800	666	2.727
6	Riparia Rupestris 2-1 RAVAZ . . . . .	1 550	525	2.952
7	Rubra Rupestris 5-3 RAVAZ . . . . .	1 350	575	2.347
8	Rubra Riparia 5-4 RAVAZ . . . . .	0	200	0
9	Berlandieri Rupestris 1-3 . . . . .	1 533	583	2.646
10	17-37 (Berlandieri Rupestris) . . . . .	1 657	700	2.367
11	44 RICHTER (Berlandieri Rupestris) . . . . .	3 550	860	4.127
12	99 " (idem) . . . . .	2 733	800	3.416
13	60 " (idem) . . . . .	1 375	587	2.342
14	110 " (idem) . . . . .	2 900	810	3.580
15	31 " (idem) . . . . .	3 500	720	4.861
16	57 " (idem) . . . . .	1 958	791	2.475
17	441-2 (Cord. Rup. Jard. X Rip. glabre) . . . . .	3 558	975	3.640
18	4 449 (144 Cordifolia Rupestris X Rupestris) . . . . .	3 066	925	3.310
19	583-38 (Rip. Rup. No. 3 JÆGER X 150-9) . . . . .	500	162	3.080
20	Rupestris du Lot . . . . .	1 937	912	2.120
21	93-5 (coudé) . . . . .	920	675	1.360
22	93-5 . . . . .	1 360	760	1.770
23	1 202 . . . . .	1 125	600	1.870
24	Aramon Rupestris GANZIN No. 9 . . . . .	916	766	1.190

*V. Berlandieri* is quite pretty and fertile, especially the RICHTER *Berlandieri*. This latter also proved to be more vigorous than other varieties of the same species.

*Cinerea* is very weak.

3306 and 3309 Couderc are always worthy of note. In this soil as in others belonging to the School, the first surpasses the second, probably because its root system develops better.

Row 14 is occupied by a cross between *V. Rupestris* and *V. Rubra* which the writer obtained some years ago. It has small interest for this type of soil.



*New Stocks tested at the Montpellier National School of Agriculture.*

## III. — Scion : CINSAUT.

Nos of the rows	Stocks	F Average weight of grapes per stocks	V Average weight of shoots per stock	$\frac{F}{V}$
1	3306 . . . . .	600 gr	783 gr	0.779
2	3309 . . . . .	1 041	666	1.363
3	101-14 . . . . .	250	516	0.048
4	Champin . . . . .	950	541	1.772
5	125-1 . . . . .	1 766	750	2.354
6	106-8 . . . . .	266	550	0.483
7	107-11 . . . . .	1 291	516	2.501
8	216-3 . . . . .	850	833	1.020
9	227-1 CASTEL . . . . .	1 750	858	2.039
10	215-1 . . . . .	1 650	675	2.444
11	Arizonica . . . . .	1 400	450	3.111
12	Cordifolia . . . . .	1 300	666	1.951
13	V. Rubra . . . . .	1 208	490	2.465
14	143-14-6 . . . . .	1 700	516	3.294
15	437-3-4 . . . . .	1 433	710	2.018
16	366 . . . . .	2 116	841	2.516
17	Salas . . . . .	1 266	600	2.11
18	Berlandieri RICHTER . . . . .	3 725	590	6.313
19	Berlandieri Rupestris No. 1 . . . . .	1 750	866	2.020
20	439-69 . . . . .	566	866	0.653
	583-7 . . . . .	3 066	666	4.603
21	H. N. 18-49 . . . . .	600	740	0.810
22	H. N. . . . .	766	450	1.702
23	H. N. 19-52 . . . . .	1 266	441	2.870
24	6266 . . . . .	1 291	1 266	1.019

216-3 is a CASTEL hybrid: *Solonis* by *Rupestris du Lot*. Interesting.  
106-8 is very weak here.

18 804 is a hybrid obtained by CASTEL from *V. Riparia* and an impure *V. Monticola*. The writer regards it as superior to *Riparia-Rupestris* in its resistance to chlorosis; he has been calling attention to its qualities for a long time past.

1 R. and 2 R. are pure *Riparia Monticolas*; their chief fault lies in their lack of vigour, which hardly exceeds that of *Riparia*. On the other

hand, they are much superior to *Riparia Berlandieri* varieties in their resistance to chlorosis.

F. GRASSET's *Cordifolia* suffers from chlorosis.

*Rupestris Rubra* 5-1 was obtained by the author. Normally, it is very vigorous but it is not suited by chalk. The hybrids of this group should be studied in other soils.

333 and 41 B are well known *Viniifera Berlandieri* varieties. In this experimental field they are very equal in value; any slight difference that may exist being in favour of 333. These 2 varieties suffered somewhat from drought.

The *Riparia Berlandieri* varieties 33-34, 420 A, 161-49 COUDERC show the same resistance to drought here as they have done elsewhere. Greater vigour would be an advantage.

The *Rupestris-Berlandieri* varieties are much stronger and also possess high resistance to chlorosis. Some of them will undoubtedly find a place in French vineyards.

The production of the French-American hybrids: 93-5; 1202; GANZIN No. 9, leaves room for improvement. This is partly in consequence of their great vigour, as some of them had their shoots broken by the wind.

The vineyard grafted with Cinsaut is older, the nature of the stock explains the feeble production of each shoot. 3306 is still more vigorous than 3309. If the quantity of fruit is less, it is because, on account of its position, it suffered more than its neighbour from the visits of passers-by. 101-14 is very weak.

*Champin* is vigorous, but unfortunately incapable of practical use; 125-1 is not suited to this type of soil which is too rich in lime; 106.8 is still very weak. Rows 8, 9 and 10 are occupied by hybrids of the same group: 227.1 seems superior to the others. *Berlandieri Rupestris* No. 1 from the Montpellier School is equally interesting.

CONCLUSIONS. — In the clayey-lime soil under consideration, the following varieties are worthy of note for their vigour and productivity:

*Rupestris du Lot*; 3306; 18-804; *Rupestris Berlandieri* and especially Nos. 99 and 110, RICHTER; 41 B and 333; 93-5, 1202 COUDERC, and *Aramon* GANZIN No 9; 216 and 227-1 CASTEL. The highest yields were given by B. RICHTER: 227-1 Castel; *Rupestris du Lot* on stone; 3306; 216-3; 18 804; 41-B; 99 and 110 R. etc. These results only refer to the first year of production; it is possible that in subsequent years they may be different. However they may well be borne in mind without there being much chance of serious errors occurring.

157 - **Black Poplars.** — HENRY, A. in *Transactions of the Royal Scottish Arboricultural Society*, Vol. XXX, Part I, pp. 14-27, Fig. 1-12. Edinburgh, January 1916.

A study of the numerous types (species, varieties, sports and hybrids) of the European black poplar (*Populus nigra* L.), and of the north American poplar (*P. deltoides* Marshall).

The glabrous kind of the European black poplar (*P. nigra* var. *typica*) is strictly limited to southern and south-eastern Europe; it is rarely

cultivated in Great Britain. Its fastigate form (*P. nigra* var. *italica*), which is the characteristic Lombardy poplar, is probably a sport. As is well-known, the pyramidal, or Lombardy poplar is nearly always of the male sex, the only female Lombardy poplar with truly fastigate habit known to the writer is in Kew Gardens. The rare female poplars reported as occurring in Germany from time to time are due to hybridisation.

The other principal variety, *P. nigra* var. *betulifolia*, is distinguished by the dense, short pubescence on its twigs; it is apparently wild in southern England and throughout France. *Populus plantierensis* is the fastigate form of the pubescent black poplar.

The north American black poplar differs from the European species in the shape of its leaves, and the presence of cilia on the margin, and glands on the base of the leaf blade in front, as well as in various floral characters. The writer distinguishes 3 geographical varieties: *P. deltoidea* var. *monilifera* Henry, from the north-east of North America (1), *P. deltoidea* var. *occidentalis*, Rydberg, from the prairie region; *P. deltoidea* var. *missouriensis* Henry, from the south-east region.

The black poplars which are cultivated for timber in France and Belgium, and also in England, are almost invariably of hybrid origin, being crosses between the above-mentioned forms of the European and American black poplar. They have been propagated on account of their exceptional vigour. The chief are: *Populus angulata* Aiton (*P. deltoidea* var. *missouriensis*  $\times$  *P. nigra* var. *typica*); *Populus serotina* Hartig (*P. nigra* var. *typica*  $\times$  *P. deltoidea* var. *monilifera*); *Populus regenerata* Schneider (*id.*); *Populus Eugenei* Simon-Louis (*id.*); *Populus marilandica* Bosc (*id.*), *Populus Henryana* Dode, *Populus robusta* Schneider, *Populus Lloydii* Henry of obscure origin. The writer discusses the origin of all these hybrids, their characteristics and botanical characters. He also gives some interesting information respecting their dimensions, and describes a wonderful tree of *P. Eugenei* which appears still to be growing rapidly, and measured when 81 years old, 150 ft in height and 25 ft in girth at 5 ft above the ground.

Until lately, all the hybrid poplars in cultivation were the result of accidental crossing, but the artificial production of fast-growing hybrids is now being attempted. The most interesting, so far obtained by Prof. Henry is *P. generosa* (*P. angulata* Ait.  $\times$  *P. trichocarpa* Forr. and Gray, the balsam poplar of the Pacific Coast) (2).

At the end of the paper is given a key to the Black Poplars, reproduced from the writers' work "The Trees of Great Britain and Ireland" (Vol. VII, 1913).

(1) Its hybrids are usually confused with the varieties *P. Monilifera* Ait. and *P. Canadensis* Mchx. (Ed.)

(2) See B. 1915, No. 31. (Ed.)



158 - **The Restoration of Forests Devastated by the Operations of War.** — JOLYET A.  
(Professor at the Ecole Nationale des Eaux et Forêts), in *La Nature*, No. 2256, pp. 401-406, figs. 1-7. Paris, Dec. 23. 1916.

The North East of France is a well wooded region and it is natural that numerous forests should have suffered as a result of the operations of war. However, though the damage incurred may have been great, it does not follow that the forests must necessarily be destroyed.

A forest is not merely formed by the sum of the plants living therein but also by the forest soil, or primitive soil modified by the existence of the forest, and by the sum of the plant and animal life there developed. The "état boisé" (wooded state) so produced represents a valuable capital and it would be a serious mistake not to utilise it as soon as possible, for this state or condition, though surviving the destruction of the forest population, does not last for ever.

There are two methods of regenerating a forest in these conditions: one natural and the other artificial. The former is not profitable, being too long, whereas the interest of the owner lies in obtaining commercial timber from his forest as soon as possible.

The first point then to establish in restoring a forest damaged by war is whether the injured trees are definitely broken or merely bruised. In the first case they must be cut down level with the ground and, provided the species is a deciduous one and not too old, new shoots will then emerge from the stump. On the other hand, if the tree is a conifer, no shoots will be formed, but by cutting down the tree the danger of encouraging insect parasites will be avoided. In the second case also, felling is almost always advisable, for a mutilated tree is not likely to produce healthy wood.

As a result of the felling, gaps of greater or less extent will occur. These it will be necessary to fill up by means of appropriate species: a) encouraging the natural reconstruction of the forest with wild species, or at any rate not impeding the same by an excessive amount of cover; b) capable of furnishing within a short period good marketable timber the sale of which will enable the proprietor to put back the forest in its original state.

Next, the 2 following cases must be considered:

1) *Gaps of large extent.* — When the removal of damaged plants leaves a very big gap, it is advisable to plant not merely a temporary but also a robust species with light shade in order to allow the reconstitution of the original species (oak, hornbeam, maple, ash, fir, etc.). The majority of pines fulfil these requirements, the Austrian pine is particularly adapted to a thin chalk soil; in sandy soil, on the other hand, Scots Pine does best; *Pinus Banksiana* Lamb. in spite of the small value of its wood is also recommended on account of its great hardiness which favours a quick recovery. As these species all require light, the plantations must be fairly thin, the trees 5 to 10 feet apart.

Clearings must then be made in succession and in this way, while obtaining an easily marketable product, the forest will eventually be com-

pletely reconstructed and rendered capable of again yielding marketable timber in its turn.

2) *Gaps of very small extent.* --- When the gap left by the removal of the plants is not above twice the height of the surrounding trees in size, the use of pines, which require a particularly large clearing, is not possible. However, as the object is to plant trees capable of early utilisation, there are other species of conifers answering to this requirement, and among these the fir and spruce are preferable. Though they give a very thick shade, the pyramidal shape of their summits will give the minimum of inconvenience to the surrounding trees, especially to the deciduous species. The fir is most advisable from the cultural point of view and the spruce from the commercial standpoint. At the same time, this would be the best way to establish the fir in forests of deciduous trees and could only add to the value of the forest as a whole.

The writer also recommends the white fir (*Abies concolor* Lindl. and Gord.) characteristic for its hardiness and rapid growth. The wood, however, is mediocre though perhaps not more so than that of the fir cultivated at a low altitude. The Douglas fir (*Pseudotsuga Douglasii* Carr.) might also be recommended as it furnishes a first class wood and grows rapidly, but there are doubts as to its hardiness. In this connection the tested Colorado variety might be borne in mind, though it grows less rapidly.

If, finally, other deciduous species are preferred to the conifers mentioned above, one might use for the big clearings, birch and false acacia instead of pines. On the other hand, in the case of the small gaps, beech, or better, ash, might be planted instead of firs and especially sycamore which can do with a fairly poor amount of light (1).

159—The Importance of *Robinia Pseudo-Acacia* L. in the Afforestation of the Steppes in the Province of Iekaterinoslav (Russia). — Колесниковъ Александръ (KOLESNIKOW, ALEXANDER), in *Сельское Хозяйство и Лѣсоводство* (Agriculture and Silviculture), Year LXXVI, Vol. CCLI, pp. 191-234. Petrograd, June 1916.

The afforestation of the Russian steppes was begun in the first half of the 19th. century, under the immediate influence exercised by the idea of creating better climatic conditions in those regions. In the history of this movement, the cultivation of the Robinia in purely forest plantations (this tree being first introduced into South Russia in the time of CATHERINE II. and cultivated as an ornamental plant) marks an important epoch.

In view of the easy reproduction, rapid growth and success of isolated plants of Robinia it was considered, especially towards 1880, as the most suitable species for the afforestation of the steppes. For example, in 3 forest properties alone in the South Russian steppes, from 1874 to 1885, there were 558 hectares (1 hectare = 2.47 acres) under Robinia, and in

(1) See: A. JOLYET: 1) La restauration des forêts dévastées par les faits de guerre, in *La Vie agricole et rurale* V. pp. 241-246, 2 figs, 1915; — 2) *Traité pratique de sylviculture*, Appendix, 6, 191; 1916; — G. DEMORLAÏNE: 1) La restauration des forêts dévastées par la guerre, in *Revue des Eaux et Forêts*, LIV, pp. 222-228, 1916; — 2) La réparation des dommages de guerre aux forêts. *Ibid.*, pp. 349-353. (Ed.).

other properties in the same region the planting of equally large areas was contemplated. However, the partisans of the Robinia were soon undeceived, for after the vigorous development of the initial years the pure plantations of this species (after some to 10 years) began to decline and eventually even to die out.

The cause of this instability of pure plantations must be attributed to the requirements of the Robinia which needs a large amount of light and can only prosper in such plantations when conditions are particularly favourable and when the strong competition of other plants is eliminated (sands with poor flora). On the clayey tchernoziom, where there is an abundant growth of herbaceous plants, the Robinia has been incapable of forming plantations of big trees owing to the early thinning of its foliage. Its feeble shade favours a strong development of grasses and subsequently the formation of a turfy layer which eventually involves the total failure of the plantation. Excessive crowding is also largely responsible for such a result. The effect of frost has only been felt in too low situations.

In the Department of Komisarovka in the forestal domain of Verkhnednieprovsk (province of Iekaterinoslav), during the period 1877 to 1885, 175 hectares were devoted to pure Robinia plantations, and 7 hectares to Robinia with *Acer Negundo*. At the present moment this area is 146 hectares. In the forest history of the Department of Komisarovka the following periods may be identified:

During the 1<sup>st</sup> period: from the institution of the Department in 1876 up till 1882, the Robinia predominates in pure plantations and is rarely associated with *Acer Negundo* L.

During the 2<sup>nd</sup> period: from 1882 to 1888, the leading place is taken by plantations of elms and ash, the oak being cultivated merely as an experiment.

During the 3<sup>rd</sup> period: from 1888 to 1894, the plantations have a mixed character and an important place is occupied by oak.

Since 1894, the oak has attracted still more attention and at the present day represents the principal species. All the care of the forester is devoted to the oak. At the present time, in recent plantations in the forest domain of Verkhnednieprovsk, the oak constitutes 33 % and sometimes even 50 % of the whole plantation.

After 1895, the cultivation of the false acacia was completely abandoned, not only in pure but also in mixed plantations. It was only after 1897, when the success of its association with oak and ash was noted, that it was again introduced, chiefly on account of its qualities as a protection for young oaks.

At the present time, the extent of these plantations in the Department of Komisarovka is 48 hectares. The type of plantation is not yet definitely settled: the Robinias are planted in lines, either alone or alternating with other species. In the latter case, when the oaks are cleared the Robinias are cut down to soil level and in the subsequent life of the plantation merely act as undergrowth of secondary importance. When planted in lines the real object is to obtain a sufficient number of plants



to distribute among schools and the population generally, which require large quantities.

At the present time, in mixed plantations of Robinia, it is usual to leave the land to cultivation for at least 2 years. In the autumn preceding the year of plantation the land is ploughed to a depth of 7 inches and left during the winter.

In spring, before planting, the land is harrowed, and after planting, when the weeds begin to appear, the rows are cleaned by hand, the cultivator being used between the rows. During the 1st and 2nd years there are four cleaning operations of each kind; during the 3rd year, three; during the 4th year, three with the cultivator and one by hand. After the 3rd or 4th year there is no further cleaning as the crowns of the trees begin to overlap and the weed growth disappears automatically as a result of the shade.

When the crowns begin to overlap and the species of more rapid growth than the oak begin to hinder this latter, they are cleared away. This is generally done in the 3rd year after the crowns have begun to touch.

The writer gives a profit and loss account based on data from the archives of the Forestal Department of Komisarovka relating to pure plantations of Robinia made in 1877, between the lines of which oaks were sown in the 2nd year, subsequently becoming the principal species. Calculating the annual interest at 4 % the following results are obtained per hectare (1 franc per hectare = nearly 4*d.* per acre): Expenses of laying down pure Robinia plantation 102.60 fr., and up to 1915: 455.70 fr.; cultivation during first 4 years (1st year, 32.10 fr. — 2nd year, 60.20 fr. — 3rd year, 38.90 fr. — 4th year 23.30 fr.), up till 1915: 651 fr.; expenses for seed and cultivation of oak, up till 1915: 48 fr. The total expenses amount to 1154.70 fr. per hectare. As regards profits, the net gain from the sale of the Robinia alone, up to 1915, is 700.40 fr. per hectare; the oak which has replaced the Robinia would give, if cut, at current prices, 999.40 fr. per acre.

According to these data the income from one acre of land has been as follows: 1) the lowest (— 15.60 fr.) for the pure Robinia plantation; better (— 7.70 fr.) for the plantation of oak alone; 3) better still (— 4.80 fr.) for the mixed plantation of Robinia and oak. If, in determining the income the annual interest is reckoned at 3.5 % or at 3 %, in the first case it is negative (— 2.30) and, in the second, it is positive (+ 0.30).

As regards the period of maximum increase of timber production, there are no data for the past, but it is supposed to lie between 40 and 50 years.

The writer summarises the experiment of the forestal department of Komisarovka as follows:

On the clayey tchernoziom the Robinia has not proved capable of forming plantations of big trees. Plantation of low trees may live if the necessary thinnings are carried out at the proper moment. Such plantations may even be profitable if there is a demand for the wood they produce. However, the cultivation of such plantations is only of secondary

importance. The principal fact to note is the favourable action of the Robinia, evidently due to its biological properties, upon the development of the forest species which live, either contemporaneously with it in the same plantation, or upon the soil previously occupied by it. For instance, in the most recent plantations in the above-mentioned department, on land previously occupied by the Robinia, both oak and ash developed in equal measure, although it is general knowledge that the latter usually develops more rapidly. Similar phenomena have also been observed in plantations of Robinia associated with oak and other species. Thus it is with regard to its properties as a leguminous plant that the Robinia requires study.

The writer finally recommends, for trial purposes, the introduction of spineless varieties of Robinia such as *R. Pseudo-Acacia inermis* and *R. Pseudo-Acacia umbraculifera*. These varieties are less exigent with regard to their requirements in the way of cultivation and, further, seem more resistant to the new enemy of *R. Pseudo-Acacia* i. e. *Lecanium cappaee* (1). Research on the biology and control of this insect is required.

## HYGIENE OF LIVE STOCK.

160 - The Treatment of *Enteritis paratuberculosis bovis specifica* by Methylene Blue (2). — STUTE, in *Berlin Tierärztliche Wochenschrift*, Year 32, No. 50, p. 594. Berlin, December 14, 1916.

HYGIENE  
OF LIVE STOCK

In September 1916, the Author found that the disease called *Enteritis paratuberculosis bovis specifica* had caused serious damage in a herd of 40 cows in West Prussia. Besides the disinfection of the shippings and isolation of infected animals, 2 grains of HOECHST methylene blue were ordered to be given per head on each of 5 consecutive days. Eight days after the first treatment, another was given, using the same amount. The animals under treatment gradually recovered and increased in weight. Judging from this result, the writer advises the study of the therapeutic value of methylene blue for this form of enteritis, as it is said by MARTENS-SANGERNHAUSEN to be effective against swine fever.

161 - Lupines as Poisonous Plants. — MARSH, C. D. CLAWSON, A. B. and MARSH, HADLEIGH, in *U. S. Department of Agriculture, Bulletin* N° 405, 44 pp. 2 fig. + 1 plates. Washington, December 5, 1916.

FEEDS  
AND FEEDING

Lupines have been cultivated and used from the time of the ancient Greeks and Romans, but their poisonous properties have been recognized only in very modern times. Heavy losses of domestic animals were reported in northern Germany in 1872 and the succeeding years.

While chemists have shown the presence of poisonous alkaloids in the lupines (dextrorotatory-lupanine, inactive lupanine, lupinidin [identical with spartein], oxylupanine), the losses in northern Germany have been considered by investigators (KÜHN, ROLOFF, ARNOLD and LEMKE, ARNOLD and

(1) See *B.* Jan. 1917. N° 116.

(Ed).

(2) See *B.* 1916, No. 877.

(Ed),

SCHNEIDEMÜHL, DAMMAN) as due not to the alkaloids but to a hypothetical substance known as ictrogen.

An investigation by Dr. SOLLMANN showed the presence of alkaloids in American lupines (*Lupinus sericeus*, *L. leucophyllus*, *L. cyaneus*) and pointed to the probability that most, if not all, of the poisoning of live stock in America was due to these alkaloids and not to ictrogen. These alkaloids are toxic or fatal if a sufficient quantity of the plant is consumed, but they are harmless if the consumption is below a certain limit. Up to this point the lupines may be a useful food if due precautions are observed that the limits are not surpassed. The alkaloids could also be largely removed by leaching with water. From SOLLMANN'S results the following conclusions are drawn :

1. Feeding with the lupines does not produce any symptoms in rabbits and guinea pigs, as a sufficient quantity is not taken in this manner.
2. The injection of extracts, by stomach or skin, is fatal if sufficiently large doses are used.

3. No ictrogen was found in any of the six specimens.

4. The toxic constituents are alkaloidal and seem to agree with those of the European species.

5. These alkaloids produce a stimulation and then a paralysis of the following structures : the respiratory and vasomotor centres, some convulsive centres, the vagus end mechanism and perhaps the vagur centre. Large doses given intravenously paralyze the heart muscle. The convulsions do not appear to be purely asphyxial.

6. Pronounced symptoms are seen only when almost fatal doses are given : smaller amounts do not produce any conspicuous effects. When death does not occur acutely, there are no late effects. Repeated administration has no influence on the action.

7. The cause of death is paralysis of respiration. Death occurs, with hypodermic administration, in 12 minutes to  $2\frac{1}{2}$  hours. When given by stomach, in 10 minutes to  $3\frac{1}{4}$  hours. The symptoms set in only shortly before death.

8. The fatal doses for rabbits by the stomach, figured for the original drugs, are as follows : for the seed of *Lupinus sericeus* and *L. leucophyllus*, between 30 and 50 grams per kg. ; for the seed of *L. cyaneus* between 20 and 100 grams per kg. ; for the hulls of *L. cyaneus* and *L. sericeus*, over 100 grams per kg.

9. The fatal dose of the crude alkaloid for rabbits, gastric administration, lies between 1.2 and 2.4 grams per kg. ; for rabbits, hypodermic administration, between 0.123 and 0.246 gram per kg. ; for guinea pigs, hypodermic administration, between 0.062 and 0.1 gram per kg. ; for dogs, intravenous administration, about 0.012 gram per kg.

10. The fatal dose for rabbits is between 5 and 10 times as large when the alkaloids are given by the stomach as when given intravenously. Guinea pigs are more susceptible to the alkaloids than rabbits when the solutions are administered hypodermically.

11. In the treatment of the poisoning, artificial respiration was found



useless. Good results were obtained with potassium permanganate, diuretin, and tea.

Extended field work (from 1909 to 1914) has verified the conclusions of SOLLMANN and has shown that all aerial parts of the lupines examined (*L. comatus*, *L. myrianthus*, *L. leucopsis*, *L. argenteus*, *L. leucophyllus*) are poisonous, the seeds being the most toxic, then in order the pods and leaves. This has been confirmed by preliminary experiments with extracts upon mice.

The toxic substance is excreted by the kidneys; the intoxication is not cumulative, and animals may eat comparatively large quantities with no ill results, if the toxic limit is not reached at any one time. Inasmuch as the toxic and lethal limits are nearly the same, the prognosis for poisoned animals is not favorable.

There is no form of remedial treatment that can be used advantageously for range animals. Poisoning in most cases can be avoided, even where the plant is abundant, by careful handling of the flocks, especial care being taken to see that hungry sheep are not grazed on fields where there is much lupine.

162 - **The Effects of Feeding the Proteins of the Wheat Kernel at Different Planes of Intake.** — MCCOLLUM, E. V., SIMMONDS, N. and PITZ, W., in *The Journal of Biological Chemistry*, Vol. XXVIII, No. 1, pp. 221-229, 17 Diagrams, Baltimore, Md., December 1916.

It has now been fully established that there are great variations in the biological values of proteins from various sources, which depend upon the proportions of the amino-acids they yield on digestion. (McCOLLUM, E. V., *The Journal of Biological Chemistry*, 1914, XIX, 323; McCOLLUM, E. V. and DAVIS M., *ibid.* 1915, XX, 415; OSBORNE T. B. and MENDEL, L. B. *ibid.* 1915, XX, 315) (1). It is not yet apparent whether an animal is as well off physiologically with a ration, otherwise satisfactorily constituted but containing a high content of protein of low value as with the same food mixture with its low grade protein replaced by its biologically equivalent amount of a much better protein. In the present paper the writers attempt to throw light on this problem. Their experiments were made with rats. The results are summarized as follows:

1. In agreement with former experience with the feeding of diets having a high wheat content emphasis must again be laid on the marked injury to the progeny which results from such restricted diets.

2. The writers were unable to make up a ration containing wheat proteins only which was adequate for the rearing of the young, although the protein content was varied from 6.5 per cent. to 47.98 per cent. Over a wide range of protein content growth approximated to the normal, but pronounced injurious effects of the ration were revealed in the reproduction records only.

3. The addition of 10 per cent. of casein to a ration which contained 36.33 per cent of protein from wheat, and which was satisfactory with respect to all dietary factors other than protein and an inherent toxicity, improved the ration in a marked degree.

(1) See also B. 1915, Nos. 72 and 73. (Ed).

4. Growth was not interfered with by including as much as 40.45 per cent. of wheat proteins in the diet, but on this the young could not be reared.

5. Growth was normal and the production of young was good on a diet containing 46.63 per cent. of protein, of which 43.0 per cent. was casein and 3.63 per cent. wheat proteins. The cause of the failure to rear the young on this diet has not yet been definitely ascertained, but would appear to be due in great part at least to the shortage of the supply of the dietary factor B, the sole source of which was the 33 per cent. of wheat in the food mixture.

6. As small an amount as 15 per cent. of whole wheat as the source of the water-soluble B, suffices for the completion of growth in the rat and so promotes well-being as to induce the production of a nearly normal number of young. The amount of this substance is not great enough to enable the young to develop to weaning age without causing pronounced nervous disturbances which end in death.

163 - **Dietary Deficiencies of the Maize Kernel.** — McCOLLUM, E. V., SIMMONDS, N. and PITZ, W., in *The Journal of Biological Chemistry*, Vol. XXVIII, No. 1, pp. 153-165, 10 diagrams. Baltimore, Md., December, 1916.

In the present paper the writers present the results of a systematic series of experiments with ground maize in which single or multiple additions of purified food substances were made. These included protein, inorganic salts, and butter fat to supply the unidentified dietary factor, the fat-soluble A. Numerous experiments have shown that the second as yet unidentified dietary factor, the water soluble B, is furnished in great abundance by even 70 per cent. of maize in the diet.

The method of procedure was similar to that described by the writers in connection with their studies of the dietary deficiencies of wheat, rice and wheat embryo (1) and the results make it clear that the dietary properties of the maize kernel are very closely similar to those of the wheat kernel. The experiments were made with rats. The conclusions are summarized by the writers as follows :

1. The proteins of the maize kernel contain all the amino-acids essential for growth, but the proportions of certain of them are such that they are not utilizable to a high degree as the sole source of protein. When other factors affecting nutrition are properly adjusted, growth has occurred at about two-thirds the normal rate over a period of 6 or 7 months, on a diet in which all the protein was derived from 91 per cent. of ground maize in the ration (9 per cent. of N  $\times$  6.25).

2. The maize kernel contains both the unidentified dietary factors, the fat-soluble A and water-soluble B. The former is present in too small amount for the maintenance of growth at the maximum rate in rats, and regardless of how satisfactorily the maize kernel is supplemented in other respects, failure of perfect nutrition will supervene within a few months unless some foodstuff containing the fat-soluble A (butter fat, certain other

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(1) McCOLLUM E. V. and DAVIS, M., *The Journal of Biological Chemistry*, 1915, Vol. XXI p. 615-643. See also B. Dec. 1915, No. 1316. (Ed.)

fats, leaves of plants, etc.) is supplied. Hot alcohol extracts the fat-soluble A from the maize kernel. The low content of the dietary A of maize was supplemented with an alcoholic extract of maize and development was induced more closely approximating the normal than without this addition, followed by reproduction and rearing of the young.

3. Like other grains which were studied, maize contains an abundance of the unidentified dietary factor, the water-soluble B. This is made evident by the fact that the maize kernel can be supplemented so as to produce normal nutrition by the addition of a suitable purified protein, inorganic salts, and butter fat, none of which carry the dietary factor.

4. The inorganic content of the corn kernel is not of a character suitable for the promotion of growth. It was found necessary in all cases to make salt additions to rations deriving their inorganic contents principally from this source, regardless of the nature of the other purified food ingredients added, before growth could take place.

5. The addition of purified protein and salts or of butter fat and salts to the maize kernel fails to induce physiological well-being throughout the life of the animal. The addition of protein and butter fat without salts forms a poorer food mixture than the pairs of additions first named. While pigs grew during several months when the diet was restricted to the maize kernel fortified with additional maize protein (gluten feed) and inorganic salt additions perfectly normal reproduction has never been observed on such rations. Young were born but the mother failed to rear them. This ration was directly comparable with that of the lot receiving the ration: maize 73, casein 18, salt mixture 3.7, agar 2, dextrin 3.1 per cent.: the dextrin carried the alcoholic extract of 5 grams of wheat embryo.

The experiments here reported with rats confirm the writers' previous observations with swine on certain rations derived solely or principally from the maize kernel and extend the experimental data relative to the quantitative values of the maize kernel as respects the several dietary factors. The results of feeding high planes of intake of maize proteins will be published later.

The writers attempted several times to nourish young rats with a diet restricted to the germ of the maize kernel, and to mixtures of the maize germ and whole ground maize in several proportions. These attempts have been uniformly unsuccessful. Two samples of germ from different dealers were employed. It is not certain just what treatment these had received, but both appeared to be wholesome products. It is evident from these trials that it is not easy, if at all possible, to make up a satisfactory ration wholly derived from the corn kernel and its parts. The nature of the dietary deficiencies of the corn germ constitutes a problem in itself.

164- **The Normal Duration of Heat (*Oestrus*) in Cattle.** — PEARL RAYMOND, in *Maine Agric. Exp. Station, Report of Progress on Animal Husbandry Investigations in 1915*. No. 519-12-15, pp. 16-18. Orono, Maine, 1916.

The agricultural Station of Maine has extensive data bearing on the duration of heat in cattle. These data arranged in the table show, for various breeds, the number of hours that elapsed between a) the time when the





breeders observed that the cow was in heat and b) the time when she was served by the bull.

From this table the following constants were deduced :

	Average number of hours from
Discovery of heat to service . . . . .	6.357 + 0.134 hrs.
Standard Deviation . . . . .	5.737 + 0.095 hrs.
Coefficient of Variation . . . . .	90.25 per cent.

From these data it appears that successful fecundation of the cow may occur as many as  $41 + x$  hours after the onset of heat. The value of  $x$  is not quite certain, but it is probably small. While, in isolated cases, successful service after as much as 41 hours may occur, the majority of successful services occur at much shorter time intervals. In fact, over 79 per cent. out of 834 successful services occurred within 10 hours after the onset of oestrus.

There appear to be no important differences between the different breeds.

Further work on this subject, in which successful and unsuccessful services will be compared, is now in progress.

165 - **The Future Utility of the Pessina Method for Determining the Age of Horses.** — DISSELHORST RUDOLF, in *Kühn-Archiv*, Vol. 6, Second Half-Vol. pp. 297-325. Halle a. S. 1916.

HORSES

The PESSINA method for determining the age of horses by their teeth is about a hundred years old. The method has often been severely criticised but without effect. Of late, age determinations of horses whose age was known have shown that the Pessina method is only trustworthy within wide limits. The researches of HEINZE, ACKERKNECHT, and MÜLLER and SCHWERDT may be mentioned in this connection.

The writer has made a thorough examination of the incisors derived from the skeletons of 42 horses and mules the ages of which were exactly known. He has also examined 12 entire skulls of solipeds bred at the Zootechnical Institute of Halle University and of which consequently the ages were also known. Finally, records were taken of the dental measurements of a large number of horses, asses and mules, still living and of known ages. The measurements were taken by means of a specially constructed rule.

The results obtained are compared with those of PESSINA. The conclusions may be summarised as follows :

1) In many cases, the observations on the cups (infundibula) in the crowns of the teeth are not in agreement with PESSINA's data. The majority of times, the age determined in this manner is in excess of the reality. The depth of the cup, particularly, is quite irregular.

2) The cups do not always disappear from the incisor of the upper jaw, in spite of these being the longest teeth. It was by no means rare to find more or less distinct traces among these teeth, whereas the infundibulum had practically disappeared from the corner tooth, which is shorter.

Traces of cups were found in the middle and corner teeth of one side of a thoroughly old horse (32 years).

3) Both in transversal and longitudinal section the grinding surfaces of the teeth in cart-horses are always 1 or 2 mm larger, but in this respect there is a good deal of variation, both between the teeth of the same jaw and between those of upper and lower jaws. The triangular form has been found to occur in a horse as young as 6 years old, and conversely, the oval form has been found in the upper jaw of a horse 18 years old.

4) In nearly all mouths, even in those of very young colts, the lower jaw is longer than the upper; it is very rare to find a pure type of bow-shaped jaw (1). Such jaws are seen, however, (asses, mules) up to an advanced age, whereas the semi bow-shaped jaw predominates among horses of any given age and may be seen to a certain extent even at the most advanced age (32 years). On skeletons at any rate this feature is incapable of serving even as an approximate indication of age. It is impossible to say of what age an angular jaw is indicative. In living subjects the gums give a somewhat different conformation to the jaws, and bow-shaped jaws are no longer seen. Here again the writer has noted from the few jaws examined, that the same form occurs in animals of fairly widely differing ages.

5) The labial walls of the alveolar processes in 3 year old colts are already shorter than the lingual walls; as the teeth increase in length, that is to say, as the animal grows older, they recede still further. The lateral walls remain for the greater part of the time at the same level.

6) As regards the "tushes", their appearance, change of shape and wear, they exhibit such variations as to lose all importance in the determination of age. By no means rarely they are completely lacking in the mare; on the other hand they are often present in both jaws.

7) The time of appearance of the V shaped groove is quite irregular, it is often observed in animals as young as 7 years. Consequently it is of no value for age determination.

#### CATTLE

166 - **Cattle in Asturia, Spain.** — NAREDO MAÑUEL and BAIO FEDERICO, in *La Industria Pecuaria*, Year XVII, Nos. 537 and 538, pp. 852-855, 862-865 + 2 plates. Madrid, Dec. 10 and 20, 1916.

The local race of Asturian cattle shows two types perfectly distinct from one another, namely the mountain and the plains type and in addition a fair number of half-breeds, the result of crossing various foreign breeds with the native animal. The mountain type inhabits the regions of high and of average elevation; the plains type and half-breeds the coastal region and fertile valleys of the interior.

*The Mountain type.* — Is found perfectly pure in the most inaccessible parts of the province and more particularly in the Communes of Aller and Caso. The hide is light red, lighter on the forelimbs; nearly white on the belly and the extremities of the limbs. Table I gives the averages of

(1) By bow-shaped, semi bow-shaped and angular jaws are meant the different forms taken by the rows of incisors of both jaws as the animal grows older.



the measurements made by the writers. It is seen that during early life, development in length is more pronounced than development in height, and that these beasts are very narrow chested, a fault which must be corrected. Another drawback is their slowness in coming to maturity, being first properly developed at the age of 5 to 6 years.

The quantity of milk produced varies from 800 to 1100 litres (1 litre = 0.22 gall.) during the lactation period, which lasts about 6 months; as the weight of cows above 3 years is about 335 kg., milk production varies between 1.32 and 1.82 % of the live weight. The milk is of good quality, its richness in dry matter and fat never dropping below 13 % and 4.5 % respectively; in some individuals the proportion of fat reaches 6 %

TABLE I. — *Measurements of Mountain Cattle (Average Values)*

	Females		Males	
	aged from 2-4 years	more than 4 years	Aged from ½ to 3 years	More than 3 years
Height: to sacrum . . . . . cm	114.80	120.30	117.12	126.33
» » mid-rump . . . . . »	110.63	117.40	113.16	122.16
» » attachment of pelvis . . »	118.80	124.10	122.04	128.66
» » to insertion of tail . . . . »	119.00	125.30	125.20	133.50
Length of trunk . . . . . »	133.20	140.30	133.48	147.00
Height of thorax . . . . . »	60.00	63.70	61.44	68.00
Width » » . . . . . »	33.10	36.20	36.84	39.00
Length of pelvis . . . . . »	44.00	46.60	45.72	50.50
Width » » . . . . . »	38.50	40.30	38.60	41.83
Girth of chest . . . . . »	157.00	166.90	160.68	181.00
» » cannon bone . . . . . »	16.00	16.80	18.36	20.33
Dactylo-thoracic index . . . . . »	1 : 9.8	1 : 9.9	1 : 86	1 : 8.8
Live weight . . . . . kg	290	350	300	450

During the period of active growth, which usually begins after the second year, these animals assimilate their food well, as proof of which the following fact is quoted: 16 animals, aged from 2 to 2 ½ years, on good pasture from the 20th September to the 1st November 1915, increased from an initial live weight of 1835 kg. to 2303 kg. a total gain of 468 kg., or 25 % of the initial weight. The fine frame and the good quality of the meat are qualities of considerable value in the fattening of mountain cattle. They are also good work animals, on account of their docile temperament, well developed muscles and general build; however, in view of the small areas under cultivation in the stock-raising districts, the capacity for milk and meat production is more important. Thoroughly well adapted to local conditions owing to its small build and great hardiness, this type is incapable of being replaced in any part of the mountainous regions of the pro-

TABLE II. — *Measurement of Plains Cattle (Average values).*

	Males and females up to 1 year	Females			Males	
		1-2 years	2-4 years	over 4 years	1-2 years	over 2 years
Height to sacrum . . . . . cm	120.39	130.00	135.75	141.85	137.00	141.00
"    "    mid rump . . . . . "	115.62	126.75	129.75	136.37	133.75	136.00
"    "    attachment of pelvis . . . . . "	126.49	135.00	140.50	145.25	143.75	146.00
"    "    insertion of tail . . . . . "	130.50	138.75	144.75	150.72	148.00	150.00
Length of trunk . . . . . "	141.70	145.00	156.50	166.14	158.50	165.00
Height of thorax . . . . . "	59.75	67.25	70.75	72.70	69.00	73.50
Width "    " . . . . . "	37.37	43.75	46.25	47.14	46.50	47.50
Length of pelvis . . . . . "	46.37	47.75	52.00	55.85	55.25	58.50
Width of pelvis . . . . . "	40.12	44.25	48.25	52.69	48.25	53.00
Girth of chest . . . . . "	164.24	179.75	194.00	205.28	197.25	219.00
"    "    cannon bone . . . . . "	19.67	20.50	20.50	21.35	22.25	25.00
Dactylo-thoracic index . . . . . "	1:8.3	1:8.7	1:9.4	1:9.6	1:8.8	1:8.7
Live weight . . . . . kg	316	430	560	600	590	780

vince. By selection and proper feeding it would be easy to produce a quicker maturing animal and to improve the milk and butter yielding capacity; in fact, this has already been proved by the writer's experiments. For instance, a cow weighing 435 kg. consumed on an average, during a period of 111 days (Dec. 1 to March 25). 10.99 kg. of dry matter per day (hay, straw, mangolds, and for 30 days a little coconut cake) equivalent to 4.11 nutritive units; the milk production was 9.88 litres daily with a fat content of 4.75 %. This means that in order to produce 1 kg. of milk, during the period of the experiment, 1.11 kg. of dry matter and 0.41 nutritive units were required.

*The Plains type.* — The hide varies from light to dark red in colour and sometimes to light chestnut.

The data in Table II show the strong development of this race; the conformation of the back is poor; the chest is better formed than in the mountain race; the pelvis is somewhat short but amply wide.

Milk production varies from 1 700 to 1900 litres. This type is an early maturing one, strong and stands well. It promises well both as a work animal and for meat production. Selection should aim at improvement along both these lines.

*Crosses.* — The above types have both been crossed with foreign breeds for some time past but no definite plan has been followed. As a consequence, along the coast and in the valleys where crossing has been most general, the herds have become rather heterogeneous in character. The foreign breeds most frequently used are Dutch and Schwitz, and occasionally Simmenthal, Durham and Flemish also.

The offspring of crosses with the Dutch breed are good as regards milk production but are not strong work animals; they are exigent as regards food, require a lot of care and considerable preparation for slaughtering. On the other hand their greater food requirements are compensated by greater milk production.

Crossing with the Schwitz breed gives an animal capable of turning its food to better account than the local breed.

Milk production, however, varies, being sometimes greater and sometimes less than that of the native type. Generally speaking these half-bred cows give less milk than the native cows during the 1st and 2nd. lactation periods, but yield more subsequently. Further, the actual lactation period is always longer than in the local type. As regards amount of work these animals are superior to those obtained by crossing with any other foreign breed whatsoever. Consequently it may be said that the crosses between the native and Schwitz breeds give a good result from all 3 points of view: beef, milk and work.

167 - Comparative Table of Milk Production in Dairy Herds in Relation to Age and Duration of Lactation, in the United States (1). — PEARL RAYMOND, in *Maine Agricultural Experiment Station, Report of Progress on Animal Husbandry Investigations in 1915*, No. 519-12-15, pp. 3-8. Orono, Maine, 1916.

Statistical data provided by milk records of various societies, suitably equalised, have been used by the Maine Agricultural Station, under the direction of the writer, in order to compare milk production in dairy herds with the age and the duration of lactation. The Table thus prepared gives a comparison between 2 dairy herds under different conditions as regards age and period of lactation of the individual animals in the herds.

The following example shows the method of use of this Table.

Given the herds made up as shown in Table II, then on Oct. 1, 1915, the average efficiency percentage would be:

	Herd A	Herd B
For cows that have calved . . . . .	$\frac{538}{14} \% = 38.43 \%$	$\frac{893}{18} \% = 49.61 \%$
For cows in milk . . . . .	$\frac{538}{11} \% = 49.00 \%$	$\frac{893}{14} \% = 63.79 \%$

The amount of milk produced on Oct. 6, 1915 being 259.5 lbs. for Herd A, and 289.4 lbs. for Herd B, the following figures for individual production, equalised and not equalised, were obtained

	Herd A	Herd B
Average for cows that have calved . . . . .	$\frac{260}{14} = 18.57$ lbs.	$\frac{290}{18} = 16.1$ lbs.
Average per cow not milking . . . . .	$\frac{260}{11} = 23.64$ lbs.	$\frac{290}{14} = 20.7$ lbs.
Calculated total milk if herd was at 100 % efficiency . . . . .	$\frac{26000}{38.43} = 676.6$ lbs.	$\frac{29000}{49.61} = 584.6$ lbs.
Average per cow . . . . .	$= 48.2$ lbs.	$32.5$ lbs.

(1) See also No. 182 of this *Bulletin*.

(Ed.)



TABLE I.  
Comparative Table showing milk production in relation to age and the duration of lactation.

Age of the cow in years and months	Months since freshening (Stage of Lactation)																		
	I	2	3	4	5	6	7	8	9	10*	11	12	13	14	15	16	17	18	19
1:6—1:11 . .	58%	54%	51%	47%	44%	41%	37%	34%	30%	27%	27%	27%	25%	26%	26%	26%	26%	25%	25%
2:0—2:5 . .	73	69	64	60	56	52	48	43	39	35	35	35	34	34	34	34	34	33	33
2:6—2:11 . .	82	77	72	67	62	57	52	47	41	36	36	36	36	35	35	35	34	34	34
3:0—3:5 . .	89	83	77	71	66	60	54	48	43	37	37	37	37	37	36	36	36	35	35
8:6—3:11 . .	93	87	81	75	69	62	56	50	44	38	38	38	38	38	37	37	37	36	36
4:0—4:11 . .	97	91	84	78	71	65	58	52	45	39	39	39	39	38	38	38	38	37	37
5:0—5:11 . .	100	93	86	79	72	66	59	53	46	39	38	38	38	38	37	37	37	37	36
6:0—6:11 . .	100	93	86	79	72	65	58	52	45	38	38	38	38	37	37	37	37	36	36
7:0—7:11 . .	99	92	85	78	71	64	57	51	44	37	37	37	37	37	36	36	36	35	35
8:0—8:11 . .	97	90	84	77	70	63	56	50	43	37	37	37	37	36	36	36	36	35	35
9:0—9:11 . .	94	88	82	75	69	62	55	49	43	36	36	36	36	35	35	35	34	34	34
10:0—10:11 . .	91	85	79	73	67	61	54	48	42	36	36	36	36	35	35	35	34	34	34
11:0—11:11 . .	88	82	76	71	65	59	53	47	41	35	35	35	35	35	34	34	34	33	33
12:0—12:11 . .	85	80	74	68	63	57	52	46	40	35	35	35	35	34	34	34	34	33	33
13:0—13:11 . .	82	76	71	66	61	55	50	45	39	34	34	34	34	33	33	33	33	32	32

\* From this sign to the end of the table the figures apply only to cows not utilised for breeding, and thus having a prolonged period of lactation. For cows whose lactation period finishes before this, the curve decreases rapidly to zero. For this Table, it is sufficiently accurate to consider that the average percentage of efficiency in a cow in the month when lactation ends is the half of the figure indicated for that month and for the respective age of the cow.

TABLE II.  
*Composition of the Dairy Herds A and B, October 6, 1915.*

Herd A							Herd B				
Progressive number of cows and heifers	Cows in milk and dry	Date of the last calving	Age in years	Months in milk	Percent of equalisation (Table I)	Progressive No. of cows and heifers	Cows in milk and dry	Date of the last calving	Age in years	Months in milk	Percent of equalisation
1	in milk	Jan. 1915	6	9	46 %	1	—	heifer	2	—	—
2	in milk	Dec. 1914	4	10	38	2	—	heifer	2	—	—
3	in milk	Sept. 1915	11	1	88	3	in milk	Sept. 1915	3	1	89 %
4	in latt.	Mar. 1915	7	7	58	4	in milk	Sept. 1915	2	1	73
5	in milk	April 1915	7	7	58	5	in milk	Nov. 1914	3	11	36
6	in milk	Jan. 1915	9	9	43	6	dry	Aug. 1914	3	—	0
7	in milk	Jan. 1915	2	9	30	7	dry	July 1914	3	—	0
8	in milk	Dec. 1914	2	10	27	8	in milk	Dec. 1914	4	10	38
9	in milk	Feb. 1915	2	8	34	9	in milk	April 1914	6	18	37
10	in milk	Dec. 1914	2	10	27	10	in milk	Sept. 1915	2	1	73
11	dry	Oct. 1914	6	—	0	11	in milk	Sept. 1915	3	1	89
12	dry	Oct. 1914	5	—	0	12	in milk	Sept. 1915	3	1	89
13	dry	April 1915	8	—	0	13	in milk	Feb. 1915	6	8	53
14	—	heifer	1	—	—	14	in milk	April 1915	8	6	63
15	—	heifer	1	—	—	15	in milk	May 1915	8	5	70
16	—	heifer	1	—	—	16	in milk	Mar. 1915	12	7	53
17	—	heifer	1	—	—	17	in milk	April 1915	12	6	57
18	—	heifer	1	—	—	18	dry	Oct. 1914	6	—	0
19	—	heifer	1	—	—	19	dry	Oct. 1914	3	—	9
20	in milk	Sept. 1915	3	1	89	20	in milk	Sept. 1915	2	1	73
Total: in milk 11 milking 14						Total: in milk 14 milking 18					
Total 528						Total 893					

This Table shows that *Herd A* is formed of much better cows than *Herd B*, the average production per cow on the same efficiency of operation basis being about 16 lbs. per day higher in the former than in the latter. In fact, *Herd A* is one of the best herds of pure-bred Holstein Friesian cattle in Maine, while *B* is only a fair average herd.

Table I also can be used for the comparison of individual cows; it forms a much more scientifically accurate basis for the age correction of advanced registry records than do the rules of entry to advanced registry of any association in the United States.

168 - **Comparison of American Advanced Registry Ayrshires with Ayrshires in Scotland in Respect of Milk Production.** — PEARL RAYMOND, in *Maine Experiment Station Report of Progress on Animal Husbandry Investigation in 1915*. No. 519-12-15, pp. 2-3. Orono, Maine; 1916.

From a comparison made by the Maine Experiment Station between the American Advanced Registry Ayrshire Records and the Scottish Milk Record Society Ayrshire Cows Records it appears that the American Advanced Registry Ayrshires outyield their Scottish sisters, on the average, from about one and a quarter gallons to three gallons per week, or roughly from 10 to 25 pounds. Looked at from a relative standpoint it appears that the American Advanced Registry Animals give, as two year old heifers or as mature cows, about 9 per cent. on the average more milk than the Scottish herds. For the three year and four year ages the percentage is higher.

The standards for admission to advanced registry are just as high for the Ayrshire as for any other breed. It appears a fair question as to whether a standard which runs less than 10 per cent. above the general average of the breed for mature cows, is sufficiently high to get the best results in the direction of breed improvement. The records of the Scottish Society correspond to American cow-test associations records in this particular that the records of *all cows* in each herd, good, bad, and indifferent, are included.

The results of such comparisons are shown in Table I.

Age of Cow	American Advanced Registry	Scottish Milk Record Society	Difference
	gallons per week	gallons per week	gallons per week
Two years . . . . .	14.84 $\pm$ .08	13.61 $\pm$ .18	1.23
Three years . . . . .	16.76 $\pm$ .14	13.84 $\pm$ .04	2.92
Three years . . . . .	17.47 $\pm$ .14	15.23 $\pm$ .06	2.24
Mature . . . . .	20.32 $\pm$ .13	18.56 $\pm$ .09	1.76

169 - **The Value of Prickly-Pear as a Cattle Feed: Experiments made at the Prickly-Pear Feeding Station at Wallumbilla, Queensland, Australia** (1). — I. SMITH FRANK, The Experimental Feeding of Cattle with Prickly-Pear, in *Queensland Agricultural Journal*, Vol. VI, Part IV, pp. 239-242, Brisbane, October 1916 — II. The Prickly-Pear Stock Feeding Experiment Station, Wallumbilla, *Ibidem*, pp. 243-244.

The objects of the experiments carried out at the above-mentioned Station were as follows :

(1) See *B.* 1915. No. 299; *B.* 1916 No. 365.

(Ed).



1) To ascertain the value of the prickly pear as a stock food.  
 2) After having established the nature of, and the limitation to, its utility, to discover a system of feeding the prickly-pear that will give the best results in practice.

3) To investigate and to demonstrate the results accruing when it is rationally employed as a component of rations for — the maintenance herds — fattening purposes — milk production — raising young stock.

In the experiments made hitherto, 18 young bullocks were used; the animals were divided into 3 lots and stall-fed, the following rations being given:

Lot I: Ration consisted exclusively of prickly-pear fed until the animals began to waste.

Lot II: Base ration of prickly-pear + lucerne hay and oil cakes.

The prickly-pear used was the *Opuntia inermis* of West Queensland, and it was given to the animals simply sliced, without being boiled or roasted previously. When fed alone, the scrub-pear soon produced a rapid loss of weight; when other food was added, it had no bad effects.

On the other hand, it has been demonstrated that the *Opuntia* is able to furnish sufficient water to prevent the animals requiring to drink. In fact, in the present experiments, the bullocks have not had any water for 4 months, and still show thrifty condition and no noticeable desire to look for water; this may be explained by the fact that the animals receiving a minimum of pear are provided through that medium with from 4 to 4  $\frac{1}{2}$  gallons per day.

The addition of minimum amounts of ordinary hays to the prickly-pear ration (lot II) has maintained weight, but resulted in a noticeable depreciation in the appearance of the animals as compared with that of the bullocks of lot III which received additional food in the form of small quantities of lucerne hay and relatively small quantities of oil-cake. The cost of the complementary nutrients works out at a little more than 2 d. per head, per day.

170 - Sheep Feeding Experiments in Kansas. — Kansas Agricultural Experiment Station Directors' Report 1914-1915, pp. 25-27; Manhattan, Kansas, 1916.

SHEEP

A sixty-day feeding experiment to determine methods of utilizing forage and other roughage abundant on the average Kansas farm was undertaken at the Kansas Agricultural Experiment Station. A lot of 313 western range lambs, averaging 54 pounds each was purchased on the Kansas City market at a cost of \$ 7.30 per cwt. Ten days after purchase these lambs were divided into six lots, and an experiment begun to determine the comparative value 1) of corn and kafir as grain, 2) of alfalfa and cowpea hay as roughage, 3) of sorghum as silage or hay and 4) of ground versus unground kafir. The lambs were fed so as to make a maximum use of roughage. Cottonseed meal was fed equally in all lots. The following table gives the results of this experiment:

*Lamb feeding Experiment.*

Rations	Lot. 1 Shelled corn, Cotton- seed meal, Alfalfa hay, Silage	Lot 2. Shelled corn, Cotton- seed meal, Cowpea hay, Silage	Lot 3. Shelled corn. Cotton- seed meal, Alfalfa hay, Sorghum hay	Lot 4. Shelled corn, Cotton- seed meal, Alfalfa hay	Lot 5. Kafir, Cotton- seed meal, Alfalfa hay, Silage	Lot 6. Ground Kafir, Cotton- seed meal, Alfalfa hay, Silage
No. lambs in lot . . . . .	50	50	50	50	50	50
	Pounds	Pounds	Pounds	Pounds	Pounds	Pounds
Average initial weight . . . . .	56.7	55.9	56.6	56.7	55.4	57.5
Average final weight . . . . .	80.9	77.3	80.4	80.4	76.6	79.1
Average total gain in 60 days . . . . .	24.2	21.4	23.8	23.7	21.2	21.6
Average daily gain in 60 days . . . . .	0.4	0.35	0.39	0.39	0.35	0.36
<i>Average daily ration:</i>						
Grain . . . . .	0.89	0.90	0.9	0.9	0.9	0.9
Cottonseed meal . . . . .	0.19	0.19	0.19	0.19	0.19	0.19
Alfalfa hay . . . . .	1.35	—	1.36	1.78	1.36	1.36
Other hay . . . . .	—	1.53	0.43	—	—	—
Sweet sorghum silage . . . . .	1.09	1.09	—	—	1.09	1.09
<i>Feed per 100 lbs. gain:</i>						
Grain . . . . .	222.13	252.99	227.25	228.01	254.4	250.0
Cottonseed meal . . . . .	46.86	53.45	48.01	48.17	53.75	52.8
Alfalfa hay . . . . .	335.58	—	344.77	450.96	385.01	378.36
Other hay . . . . .	—	431.57	110.58	—	—	—
Sweet sorghum silage . . . . .	271.11	307.06	—	—	308.76	303.43
	\$	\$	\$	\$	\$	\$
Cost of 100 lbs. gain . . . . .	5.60	6.19	5.52	5.73	6.03	6.18
Cost of total feed . . . . .	1.35	1.32	1.31	1.35	1.28	1.33
Initial cwt. value . . . . .	7.30	7.30	7.30	7.30	7.30	7.30
Final cwt. value . . . . .	8.05	8.05	8.00	7.90	7.90	8.05
Average initial value of lamb . . . . .	4.14	4.08	4.13	4.14	4.04	4.20
Average final value of lamb . . . . .	6.51	6.22	6.43	0.35	6.05	6.37
Average profit on lamb . . . . .	1.02	0.82	0.99	0.86	0.73	0.84

Price of grain per cwt.: Shelled corn, \$1.25; Kafir, \$1.10; ground Kafir, \$1.20; cottonseed meal, \$1.30.

Price of roughage per ton.: Alfalfa hay, \$10; cowpea hay, \$8; sorghum hay, \$6; sweet sorghum silage, \$4.

*Price of lambs per cwt.*: The initial value is 60 cents per cwt. higher than the market cost, to cover expense of shipping lambs to the feed lot; the final value is 60 cents lower than market price, to cover expense of shipping them to market.

The combination of shelled corn, cottonseed meal and silage resulted in the most rapid gains, the lowest cost of production, and the greatest profit. Cowpea hay can be substituted for alfalfa in those sections of the State where it is advisable to grow it. The lambs which received alfalfa hay without silage did not in any way give as satisfactory returns as those having silage as part of the ration.

There was no advantage gained by grinding kafir.

Sheep raising has proved to be an extremely profitable industry in those sections of the State adapted to the growing of grass and other roughage. Sheep require more fencing and more care and better housing facilities than cattle under similar conditions. Where sheep are handled as one of the main sources of income it is necessary that the unit be large enough to utilize labor economically. A small flock on the farm can usually be maintained with comparatively little expense for feeds and with labour that would otherwise be considered of little or no value.

171 - **Pumpkins as Food for Sheep.** — FAULKNER, A. F., in *The Journal of Agriculture*, Vol. XIII, No. 4, pp. 266-268, 1 Fig. Wellington, October 20, 1916.

The writer indicates the satisfactory results he has obtained in growing pumpkins for sheep-feed in Wairakaia, Gisborne, New Zealand. They were grown according to the following method: the land is ploughed before the middle of August, worked fine in September, then tined harrowed once a fortnight to destroy any weeds. Sowing is done in October on the flat in rows 16 to 18 ft apart and in clumps of 3 seeds a yard apart in the row. With a single-furrow plough a man can line out rows of 16 to 18 feet apart at the rate of about 16 acres a day, and 4 men or boys can sow 16 acres a day using 4 to 6 lbs of seed per acre. The plough-furrow should not be more than 2 in. deep. Transplanting for gaps is not necessary; it is better to fill in with fresh seed. The crop is intercultivated with single, double, or 3-horse cultivators, the row between and round the plants being worked by hand. If manure is needed, a handful of guano to each clump of 3 seeds gives good results. If the best seed is saved by the grower, such as those showing the best keeping and feeding properties, the crop can be much improved.

A paddock of 17 acres contained the pumpkin crop, besides a 13-ton stack of lucerne hay, to which the sheep had free access. 1500 ewe hoggets were put in on the 14th June and were run 5 days on pumpkins and one day on grass till the 15th August — a total of 50 and 12 days respectively. When the sheep are first put in they eat all half-ripe and soft-skinned ones. After about a week it is necessary to commence splitting the harder pumpkins. Splitting for 1500 sheep takes about an hour a day. Hay is absolutely necessary for sheep on pumpkins.



172 - **Egyptian Sheep.** — *Bulletin of the Imperial Institute*, Vol. XIV, No. 2, pp. 282-284. London. April-June, 1916.

Although sheep-breeding cannot be said to be an important industry in Egypt, the animals occur in fair numbers in parts of the country. They are sometimes allowed to graze along the canal banks or are fed on Egyptian clover (*Trifolium alexandrinum*) and other crops, but the best are raised on the natural pastures in the north of the delta and along the Mariut coast-region. Considerable quantities of wool are exported, chiefly to the United Kingdom. In 1915 the total exports amounted to 72 734 cwts. valued at L. E. 255 273 (= £. 252 182 6 s.). There is also a considerable trade in Egyptian raw hides and skins, the value of the total exports in 1915 amounting to L. E. 167 519 (= £. 172 045 2 s.). of which L. E. 50 683 (= £. 52 055 8 s.) represented sheep and goat skins. Large quantities of tanned hides and skins are exported, the total value in 1915 amounting to L. E. 135 280 (= £. 135 629 8 s.) the value of tanned sheep and goat skins included in this total being L. E. 27 441 (= £. 28 184 2 s. 6 d.). The principal tanning material used is sant pods (*Acacia arabica*) the best of which are stated to be brought from the Sudan.

Three breeds of sheep are found in Upper Egypt, viz.: Saidi, Ebeidi and Sanabawi. The first-named occurs most commonly in the district south of Assiut. It possesses long, silky wool, black or brown in colour as a rule, but occasionally white. The skin is thick and more in demand locally than any other for making leather for native shoes. The Ebeidi, which occurs in the district north of Assiut almost as far as Giza, is one of the most important kinds found in Egypt. The sheep in the region mentioned are better nourished than in other parts of the Upper Egypt and the meat of this breed is consequently much better than that of the Saidi. The wool is white, but it contains a high proportion of fat, which imparts a yellowish tint to the shorn wool; it is long and silky and samples of skin wool are said to have realised as much as 14½ d. per lb. at Liverpool. The Sanabawi, which is thought to be a cross between the Saidi and Ebeidi, is found in the neighbourhood of Sanabo in Assiut Province. The wool is fine and silky but rather weak; it is usually white, but sometimes reddish.

In Lower Egypt also three breeds occur. These are the Ooseemi or Merais, Fellahi and Rahmani. The Ooseemi is found pure in Giza, but it is largely used for breeding; crosses of this sheep with Rahmani and Ebeidi are found in different parts of the country, and it is said to be supplanting the latter breed in some parts. The wool is white and normally long stapled with a silky lustre, but that of the second shearing is shorter. First quality white skin wool of this breed is said to have been sold in Liverpool at 14 d.-17 d. per lb. The skins are of good quality, and are usually exported to Europe. The Fellahi is found commonly in the northern parts of Gharbia and Daqahlia, occurring in the Barari or waste lands in the whole north of the Delta. The pastures in this region are some of the best in Egypt, and there is a plentiful supply of berseem. These advantageous conditions of feeding render it possible for the Fellahi ewes to be milked for the manufacture of cheese and butter. The wool is similar to that of the Saidi,

being black, long and silky with a good deal of grease. A sample of skin wool of this breed was priced in Liverpool as 13 $\frac{1}{4}$  d. — 14 $\frac{1}{4}$  d. per lb. The Rahmani, originally imported from Syria, is found throughout the north of Beheira and Gharbia. The grazing ground here is good, and the Rahmani mutton is consequently of excellent quality, being brighter in appearance than that of the Ebeidi, but not so fat. The wool is long, usually red in colour, but occasionally dark brown or nearly black. It resembles mohair to some extent, being mostly free from grease and rather hairy in texture. The wools of this breed and of the Saidi are in good demand for the manufacture of native cloth, and are preferred for this purpose to the white wool furnished by some breeds. The skins are of good quality and are mostly exported to Europe.

A breed of sheep found in the Barqa district of Eastern Tripoli and known as the Darnawi, Gharbawi or Barquei, occurs along the Mariut coastline of North-west Egypt. These sheep are well fed and the ewes are milked, whilst the quality of the meat, especially that of the lambs, is excellent.

Sudanese sheep occasionally come into the Egyptian market. They can be recognized by their greater size and absence of true wool, their covering consisting merely of short hairs of no value. The skins, however, are of good quality, and are in demand for export.

173 — **Goat Raising in the States of Piauí and Maranhão, Brazil.** — DE ASSIS IGLESIAS FRANCISCO, in *O Criador Paulista*, Year XI, No. 11, pp. 297-299, 8 fig. São Paulo, November 1916.

GOATS

Notwithstanding the fact that the States of Piauí and Maranhão are well adapted to goat raising on a large scale, the breeding of these animals is restricted to the small holders or colonists, each of whom keeps a little flock.

The animals are very mixed in character; it is, however, possible to distinguish among the varying types, 2 breeds which are in course of becoming fixed: 1) one of a light cinder colour, height a little above the normal, and a good fattening animal; 2) another, hornless, chestnut coloured, but with: the lower part of the body, the extremities of the limbs, the lower part of the tail, the escutcheon and face, black; the line of the back chestnut coloured but darker, the head well formed with straight profile. This latter is the so called "caninde" race. The following measurements are given:

Live weight of adult animal. . . . .	39 kg.
Length . . . . .	65 cm.
Height to shoulder . . . . .	56 cm.
"    " sacrum . . . . .	59 cm.
Length of ear . . . . .	11 cm.

The writer records a goat which suckled 2 kids and gave in addition a litre of milk a day, without receiving any special care. The litters are frequently double or triple.

In the region under consideration, goats are not subject to any disease; their one enemy is the "onca" or jaguar (*Felis onca*). As a protection they are folded at night and in fact make their way to the fold themselves without any attention.

In 1913, the State of Piahy exported 266 556 goatskins, valued at 273 452 726 *milreis*. Only the skins are exported; the meat is utilised on the spot for human or animal consumption, (for instance, boiled with the seeds of the Bengal bean (*Mucuna utilis*) they make an excellent feed for pigs).

174 - **Substitution of Potatoes by Mangels in the Fattening of Pigs; Experiments in Germany.** — RICHARDSEN, in *Deutsche Landwirtschaftliche Presse*, 43<sup>rd</sup> Year, No. 89, p. 715. Berlin, November 4, 1916.

The above experiments were carried out at the model farm of Dikopshof. Six animals were stable reared and subsequently given, as a trial experiment, in addition to a basal ration, as much roots as they could eat. They developed more slowly than with a potato ration but quite normally. At the age of 10 months the pigs were fattened off. The daily ration per 1 000 kg. live weight consisted of: 16 kg. barley, 35 kg. sugar beets, 35 kg. mangolds, 1 kg. fish-meal, 2 kg. blood-meal. This ration was changed every 3 weeks in proportion to the increase in live weight. Further, each pig was given 24 grams of chalk daily. The roots were cooked, cut up and mixed with the meal. They were taken with appetite, especially the mangels.

The fattening period lasted 63 days and gave the following results:

	Increase in live weight per day
1. . . . .	0.476 kg.
2. . . . .	0.571
3. . . . .	0.667
4. . . . .	0.579
5. . . . .	0.603
6. . . . .	0.587
Average. . . . .	0.581

An average daily increase in live weight of 581 grams may be considered a good one, especially as the pigs were well fattened and gave excellent meat. It results that mangels may well be substituted for potatoes, but fattening is rather slower.

## FARM ENGINEERING.

175 - **Importation of Agricultural Machines and Implements into Russia from 1903 to 1912.** — *Сборникъ статистико-экономическихъ сведенийъ по сельскому хозяйству Россіи и иностранныхъ государствъ* (Summary of statistical and economic data relating to the agricultural industry in Russia and abroad), Vol. VIII, pp. 380-383. Petrograd, 1915.

The above publication of the Russian Department of Agriculture gives the data relating to the importation of agricultural machinery (1) summarised in the following Tables (See Table, pages 280-283).

(1) For trade in agricultural machinery in Russia in 1911, 1912 and 1913, see: *B.* 1914, No. 562 — *B.* 1915, No. 949 — *B.* 1916, No. 1205. (Ed.)



176 - **A Double Plough for Disabled Soldiers.** — *Deutsche Landwirtschaftliche Presse*, Year 43, No. 102, pp. 832, 1 fig. Berlin, December 20, 1916.

The seat can be moved horizontally and vertically so that the disabled man can adapt the seat to suit him and guide the plough like a bicycle and regulate the working depth. To the right or left of the plough an adjustable support can be placed to support the injured limb of the worker.



Double Plough for Disabled Soldiers.

As the weight of the man rests entirely on the small furrow wheel the draught of the plough is little increased.

The seat is provided by this firm for all the double ploughs constructed by them.

The "Deutsche Landwirtschafts-Gesellschaft" (German agricultural Society) has given this plough the commendation: "new and remarkable".

177 - **Aebi High Pressure Liquid Manure Pump (1).** — *La Terre Vaudoise*, 8th Year No. 45, pp. 363-364, 2 figs. Lausanne, Nov. 4, 1916.

The gravity system of distributing liquid manure over the fields of a farm by means of a conduit necessitates the placing of the farm buildings on the high land, which is not always practicable.

The new pump constructed by the firm of AEBI and Co., at Berthoud (Switzerland) allows of treating, with little trouble and small expense, land situated as high as 150 feet and even 300 feet above the farm house. The liquid is forced through a conduit into a reservoir situated on the high land. Connections too may be fixed at various levels to the main pipe, or on lateral branches. By attaching hempen tubes with nozzles it is possible to water several pieces of land in succession while the pump is at work. The reservoir may be filled by working the motor at any odd time and the liquid distributed by gravity.

The pump figured herewith is driven by a toothed gear run from fixed

*Importation of agricultural machines and implemen*

	Total annual imports	Ploughs	Steam ploughs	Harrows	Manure spreaders	Drills	Reapers and harvesters	Binders	Side-delivery harvesters
Total annual imports . . . . .	1903 723 325 1904 642 108 1905 586 342 1906 626 494 1907 769 361 1908 686 186 1909 1 036 978 1910 1 092 582 1911 1 507 671 1912 1 729 905	114 799 86 778 94 033 103 332 120 547 134 045 122 896 159 302 136 480 141 758	156 81 16 129 188 188 795 1 031 2 727 12 092	11 480 15 866 13 884 10 388 14 878 17 063 29 307 31 664 38 769 60 404	698 409 329 654 1 295 1 372 4 181 7 192 5 100 5 066	5 497 4 425 4 996 9 407 6 203 7 580 11 564 21 570 45 803 92 269	50 959 29 557 28 110 66 185 80 871 108 498 152 011 87 336 140 277 105 786	117 506 143 957 152 483 92 940 162 887 91 526 189 012 176 597 423 753 449 950	64 78 84 69 61 55 79 52 112 45 20 05 69 10 80 60 99 32 163 273
Principal countries of origin:									
Austria-Hungary . . . . .	1903 55 505 1904 25 649 1905 54 800 1906 32 036 1907 42 425 1908 38 114 1909 42 797 1910 74 268 1911 70 266 1912 82 282	8 390 3 950 28 513 1 816 8 418 12 186 11 691 11 908 9 538 13 936	—	21 15 36 23 372 632 101 191 933 283	25 — 30 — 255 408 873 1 302 527 365	998 707 1 311 902 2 004 1 819 3 287 5 834 6 208 13 698	24 15 11 6 4 17 7 34 — 17	384 86 266 116 286 18 20 90 158 46	13 12 207 153 31 66 49 80 122 291
Belgium . . . . .	1903 116 1904 20 1905 244 1906 63 1907 14 498 1908 4 095 1909 134 1910 483 1911 92 1912 11 750	21 — 64 — — — — — — 314	—	—	—	2 — 123 — — 93 — 147 — —	10 — — — — — — — 4	— — — — 14 251 3 918 — — —	— — — — — — — — —
Denmark . . . . .	1903 16 507 1904 3 693 1905 2 988 1906 4 485 1907 14 832 1908 39 751 1909 64 806 1910 3 067 1911 4 868 1912 23 538	96 77 24 18 53 58 63 9 86 143	—	1 978 609 10 6 150 371 2946 199 293 1 157	39 44 — 97 221 40 159 25 87 48	75 50 — 10 43 12 153 18 21 2 040	2 002 164 13 171 4 175 2 664 15 221 486 190 1 967	4 661 343 1 498 2 2 664 1 451 30 492 25 1 921 6 946	931 — 129 940 4 750 5 358 7 441 22 19 7 243

o Russia from 1903 to 1912 (in metric tons).

Rakes	Threshers	Steam threshers with beater cylinders	Locomotives for threshers and ploughs	Winnowers and sorters	Graders for potatoes, etc.	2 cylinder clover-hullers	Baling presses for hay, straw, flax, hemp, etc.	Chaff-cutters, etc.	Various agricultural machinery	Spraying apparatus, bellows and syringes for vines	Grape presses	Continuous grape presses	Churns and separators	Centrifugal separators and their parts	Machines and implements of recent invention for Agricultural Stations and Museums
584	29 307	91 617	114 966	10 917	1 091	1 729	720	8 110	44 665	352	199	832	991	4 778	9 589
38	20 973	73 633	90 165	7 851	147	935	614	7 033	36 729	583	195	185	879	3 709	2 667
60	10 510	65 175	80 209	6 730	80	276	1 366	6 150	40 511	360	8	284	971	5 608	1 942
65	15 085	87 535	54 311	7 491	148	1 141	390	6 100	39 289	166	8	319	982	7 673	15 244
328	20 925	47 731	62 894	9 850	364	920	551	7 721	65 183	507	24	237	1 431	8 912	2 157
137	23 797	45 363	70 824	10 368	358	3 603	528	7 361	77 980	479	12	681	1 436	6 656	9 878
69	27 324	68 858	104 158	9 623	710	13 525	1 413	9 918	111 942	453	97	303	1 599	9 723	17 791
48	34 227	104 409	144 930	17 185	1 098	6 589	3 864	10 894	136 692	926	83	223	1 412	9 312	1 994
81	33 695	117 299	147 253	17 257	1 174	3 558	2 254	13 054	160 125	1 974	133	330	1 672	10 982	5 351
72	34 959	111 743	140 639	21 234	1 178	4 372	5 507	5 507	271 518	1 043	64	103	1 868	10 225	6 383
49	8 533	9 749	9 981	4 682	7	107	101	2 699	9 728	9	—	—	3	3	—
40	3 919	2 294	2 637	2 076	5	46	2	2 325	7 467	26	1	1	17	8	—
6	3 573	3 099	5 128	3 470	19	16	41	1 891	7 122	13	3	—	33	11	—
5	3 832	5 855	6 308	4 231	35	—	7	2 376	2 864	1	—	40	9	37	418
2	5 281	6 084	6 870	3 909	—	16	2	2 627	6 117	8	—	—	9	131	1
7	6 266	1 821	2 866	4 578	6	324	87	2 082	4 811	7	1	68	26	18	—
16	8 357	2 322	3 210	5 238	1	303	123	2 044	5 046	1	—	—	2	72	36
11	10 660	10 117	11 801	7 196	12	349	104	3 209	11 320	30	7	—	12	17	—
5	11 659	7 139	7 008	8 512	5	166	20	4 890	13 238	26	—	—	17	90	2
7	9 609	3 659	6 538	11 078	2	118	316	5 618	16 571	—	2	—	5	55	65
—	—	—	—	—	—	—	—	—	1	—	—	—	—	79	—
7	—	—	—	—	—	—	—	—	1	—	—	—	12	—	—
—	—	—	—	—	—	—	—	—	18	—	—	—	—	39	—
—	—	—	—	—	—	—	—	—	19	—	—	—	—	43	—
—	—	—	70	45	—	—	—	—	124	—	—	—	9	—	—
—	—	—	—	—	—	—	—	—	18	—	—	—	—	67	—
—	—	—	—	—	—	—	—	—	53	—	—	—	—	55	25
—	—	—	202	—	—	—	—	—	—	—	11	—	1	123	—
—	—	—	—	—	—	—	—	—	—	—	—	—	—	92	—
52	594	—	—	—	—	44	—	—	3 250	—	—	—	—	—	—
78	188	208	197	—	—	—	—	20	1 001	—	—	—	257	818	1 955
28	46	—	—	—	—	20	—	7	1 290	—	—	—	116	630	67
—	3	—	—	3	—	—	—	7	405	1	—	—	186	606	101
14	—	—	—	—	—	—	—	9	313	—	—	—	374	1 544	86
24	—	115	118	—	—	80	—	112	210	—	—	—	603	1 313	—
11	13	—	—	13	—	—	—	7	1 786	—	—	—	668	724	42
185	—	13	—	1	—	—	10	12	262	—	—	—	509	675	1 107
33	32	30	—	—	—	—	—	31	84	—	—	—	492	1 565	17
53	11	12	—	—	—	—	—	26	43	—	—	—	500	1 538	69
39	70	—	—	—	—	18	—	25	632	—	—	—	479	1 283	189



## Importation of agricultural machines and implements

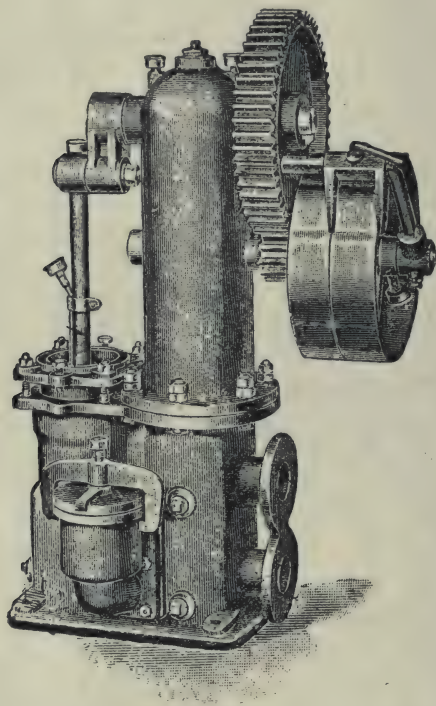
		Total annual imports	Ploughs	Steam ploughs	Harrows	Manure spreaders	Drills	Reapers and harvesters	Binders	Side-delivery harvesters
Germany . . . . .	1903	247 584	104 344	4	2 878	618	3 907	1 140	7 419	1 140
	1904	244 440	79 978	—	3 433	365	2 998	3 143	16 283	10 140
	1905	186 125	62 970	16	2 755	383	3 130	1 202	21 750	1 140
	1906	209 171	97 126	—	2 167	531	4 301	5 840	10 133	1 140
	1907	260 795	104 865	129	7 078	797	3 634	11 963	15 978	10 140
	1908	334 636	114 365	34	7 149	758	3 904	30 000	47 093	4 140
	1909	468 890	106 750	269	5 878	3 051	5 673	57 406	77 816	9 140
	1910	407 070	144 813	382	4 565	4 389	6 781	4 203	16 544	3 140
	1911	444 214	123 779	424	12 728	4 418	8 383	6 404	52 405	1 140
	1912	608 861	117 653	863	17 307	4 567	12 213	18 393	74 366	44 140
Sweden . . . . .	1903	5 331	100	—	95	—	2	1	—	—
	1904	3 965	329	—	433	—	—	46	56	—
	1905	5 187	270	—	526	—	—	80	174	—
	1906	5 839	371	—	295	—	—	137	—	—
	1907	18 846	214	—	304	—	20	8 504	422	18
	1908	25 018	229	—	728	62	112	12 429	941	22
	1909	17 551	568	—	518	—	79	1 345	3 777	75
	1910	46 425	531	—	1 886	2	515	16 092	1 646	27
	1911	66 509	726	—	1 858	—	951	27 098	3 234	54
	1912	52 781	294	—	510	—	2 374	16 324	1 883	45
United Kingdom . . . . .	1903	160 547	450	152	1 108	16	142	13 071	9 828	2 850
	1904	123 098	853	—	4 092	—	18	6 819	6 164	7 880
	1905	101 502	1 672	—	4 122	16	44	351	7 685	1 930
	1906	70 774	318	48	3 130	6	48	3 120	7 656	16
	1907	114 645	1 395	58	2 580	—	37	12 066	9 220	15 560
	1908	110 497	2 371	—	2 544	10	98	4 191	18 796	3 130
	1909	188 827	556	267	329	4	582	16 993	18 320	17 420
	1910	169 935	744	378	1 263	1 221	3 159	6 395	7 479	57
	1911	214 829	1 192	444	3 286	36	2 202	728	23 611	4 280
	1912	257 972	878	588	7 132	24	13 849	11 014	24 585	16 210
United States . . . . .	1903	231 402	737	—	4 898	—	356	34 669	95 212	57 600
	1904	239 064	1 278	21	7 270	—	651	10 330	120 120	66 500
	1905	227 361	159	—	2 773	—	383	24 303	121 104	58 030
	1906	297 075	348	23	2 456	9	4 135	56 656	75 026	76 930
	1907	295 603	5 313	—	4 343	9	454	44 151	117 066	81 110
	1908	130 639	4 205	137	5 394	—	1 625	38 382	18 518	6 990
	1909	246 049	2 350	203	19 262	93	1 749	58 954	58 588	33 340
	1910	385 317	422	271	23 398	104	5 257	60 033	150 350	75 660
	1911	697 881	781	1 859	19 526	33	28 031	105 845	339 066	92 670
	1912	671 776	7 152	10 607	32 667	63	48 021	52 697	334 115	93 700

Russia from 1903 to 1912 (in metric tons).

kates	Threshers	Steam threshers with beater cylinders	Locomotives for threshers and ploughs	Winnowers and sorters	Graders for potatoes etc.	2 cylinder clover-hullers	Baling presses for hay, straw, flax, hemp etc.	Chaff-cutters etc.	Various agricultural machinery	Spraying apparatus, bellows and syringes for vines	Grape presses	Continuous grape presses	Churns and separators	Centrifugal separators and their parts	Machines and implements of recent invention for Agricultural Stations and Museums
171	15 813	27 546	39 406	6 633	1 069	1 089	340	3 424	23 185	105	58	289	317	1 003	1 082
170	14 999	33 231	39 951	5 611	136	683	495	2 961	22 299	117	175	50	423	1 399	2 352
169	4 774	21 248	29 365	3 116	60	166	1 133	2 855	26 159	105	5	141	564	2 707	484
126	10 002	19 989	20 961	2 972	113	1 039	164	2 017	24 439	7	8	247	477	2 872	310
173	10 211	16 939	19 596	5 739	355	639	531	2 916	37 792	176	18	262	459	1 531	507
175	10 165	17 793	23 802	5 664	349	3 052	427	3 922	48 899	174	4	349	484	1 844	231
138	9 617	22 863	37 731	4 350	709	8 655	619	5 498	89 675	256	97	257	468	2 578	520
181	12 291	37 475	48 340	8 864	1 061	2 490	1 343	5 650	92 788	585	63	211	522	2 950	405
112	8 436	38 364	48 888	8 155	1 117	979	1 036	5 412	104 908	439	97	123	607	4 529	1 167
102	10 579	43 305	53 622	7 259	1 137	2 083	2 347	5 437	168 561	470	21	103	940	3 785	1 294
28	135	948	1 073	—	—	—	—	44	54	—	—	—	247	2 601	1
2	56	39	1 261	—	—	—	—	6	308	—	—	—	114	1 248	—
97	47	843	848	—	—	—	—	24	129	—	—	—	129	1 994	1
84	14	367	1 211	—	—	—	—	3	324	—	—	—	46	2 986	—
14	37	1 429	1 455	—	—	—	—	33	96	—	—	—	188	5 843	—
198	112	630	1 368	—	—	—	1	48	765	—	—	—	161	3 703	—
153	363	543	1 754	—	—	947	—	30	676	—	—	—	117	4 039	87
189	1 056	3 070	5 179	12	—	2 342	—	136	1 268	—	—	—	215	3 589	10
232	911	2 752	3 891	3	—	—	—	39	2 495	—	—	145	229	4 063	145
142	612	418	758	9	—	—	48	47	5 232	—	—	—	179	3 935	29
150	3 879	50 346	63 485	78	15	465	279	1 608	4 211	—	—	111	76	79	134
102	2 322	37 854	46 039	53	6	123	—	1 689	3 122	—	—	—	72	341	47
72	1 634	33 462	43 937	52	—	95	180	1 985	3 878	9	—	—	31	68	271
318	1 105	21 497	24 247	241	—	223	71	1 514	5 905	86	—	—	53	9	10
125	4 700	22 338	31 636	59	7	186	—	1 948	4 154	49	—	—	135	45	342
293	6 931	24 641	41 124	46	—	181	—	1 184	3 847	6	—	—	56	36	5
286	8 162	41 660	58 299	13	1	3 613	105	1 274	6 626	—	—	—	46	260	7
409	9 149	52 411	74 266	431	25	1 313	34	1 128	6 702	141	—	—	115	594	981
315	9 305	67 441	81 956	25	41	2 092	29	2 283	11 798	95	—	6	162	131	3 371
268	10 381	62 922	76 088	1 360	35	1 378	528	7 712	15 527	82	—	—	70	197	143
189	650	2 657	655	11	—	68	—	165	4 481	45	—	—	79	—	6 412
999	414	153	199	—	—	64	115	44	2 166	196	—	—	122	52	200
415	255	5 789	698	7	—	—	5	154	2 018	80	—	—	25	24	1 084
137	130	39 430	934	19	—	179	61	160	2 770	33	—	—	17	20	14 421
183	643	808	3 155	24	—	—	13	50	12 945	7	—	—	14	—	1 307
151	267	477	1 532	32	11	46	13	90	16 884	148	—	—	36	102	9 600
348	635	1 456	2 958	—	—	7	540	1 005	9 188	152	—	—	400	3	9
646	618	1 183	3 561	641	—	92	2 340	700	23 339	90	—	—	24	3	581
851	3 020	1 430	4 116	522	10	321	1 152	388	26 469	98	—	—	17	12	597
288	2 515	1 439	2 631	1 431	—	712	2 224	1 136	58 670	15	—	—	17	24	4 663

and free pulleys and may be worked by the ordinary farm motor. A farmer who has installed one on his property estimates its capacity to be 44 gallons per minute with 3 HP motor and 1300 feet of 75 mm. tubing.

The AEBI pump would be useful for the direct distribution of liquid



A E B Liquid Manure Pump (A B C).

manure on uniformly level land or even for reaching higher land, and in conjunction with a reservoir when the differences in level are more important. It will considerably lighten the cost of carting and distribution, especially on the higher parts of the property.

**178 - Guiding Mechanism for Seed Drills and Similar Machines.** — *Illustrierte Landwirtschaftliche Zeitung*, Year 36, No. 102, p. 676, 1 fig. Berlin, December 20, 1916.

This guiding mechanism made by V. RAÜBER (of Bernitt, Mecklenbourg) under German patent N° 290 239 (1) has the advantage of allowing the driver, placed on a seat, to use his hands solely for the reins and whip, while he guides the machine with his feet.

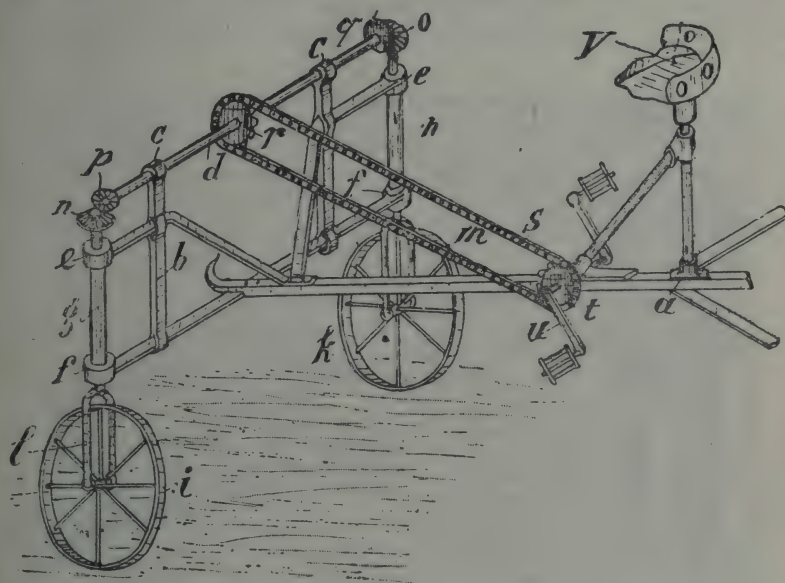
As the figure shows the frame *b* fixed to the beam *a* carries both the

(1) See *B.* 1916, N° 1210, p. 1717.

(Ed.)



uprights *c* supporting a horizontal bar *d* and also the uprights *e* and *f* for the vertical axles *g* and *h* of the guiding wheels *i* and *k*. The axles end in forks *l* and *n* on which the wheels *i* and *k* run ; they also bear on top the bevel gears *n* and *o* (arranged so as to obtain the same direction of rotation for both axles) which engage with the complementary gears mounted on



Guiding Mechanism for Seed Drills and Similar Machines.

the ends of the horizontal bar *d*. The latter is set in motion by a chain *s* driven from a gear wheel with pedals *u* below the driver's seat and worked by his feet. By turning the pedals the direction of the machine can be changed. Considering the lack of manual labour and the need for finding work for disabled soldiers, the machine is of interest.

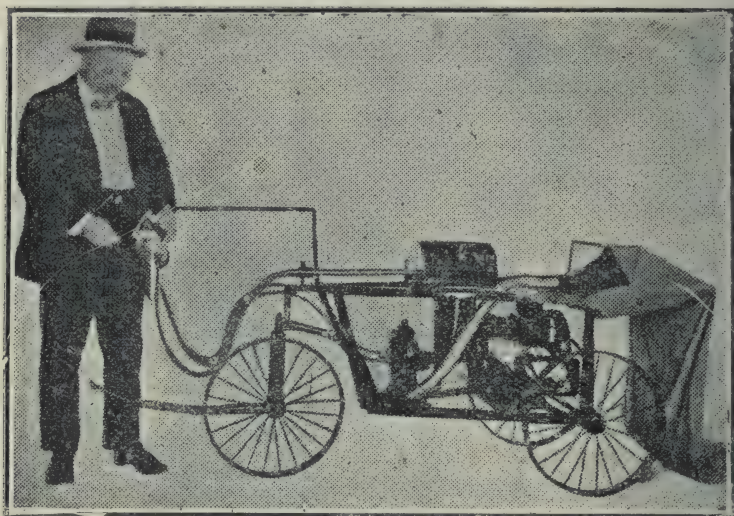
179- **A New Cotton Picking Machine.** — *Cotton and Cotton Oil News*, Memphis, Tenn. July, 24, 1916; reprinted in *Queensland Agricultural Journal* Vol. VI, Part 4, pp. 218-219, 1 fig. Brisbane, October, 1916.

This machine, constructed by the Southern Cotton Picker Company, Memphis, Tennessee, U.S., is certainly not complicated and it appears as easy of operation, as it is simple in construction. It does not pick with suction, but with brushes.

The picker head, which is driven by a flexible shaft, contains two bristle brushes that mesh together at a velocity of 400 revolutions a minute, a small toothed pin wheel combs the cotton from the brushes, which is then conveyed through a 1 1/2 inch tube into a container sack in the rear by suction, a small fan creating the vacuum behind the picker head which conveys the cotton into the sack.

The operator, after starting the engine, has nothing to do but apply the picker head with flexible tubes to each boll that is open, and instantly the cotton is deposited in the conveyor used for this purpose.

The picker head is protected against entry of any foreign matter or boll by a wire guard over its end just outside of the brushes, through which guards the brushes work, pulling the cotton into same, making it impossible for a boll to go through this guard, and nearly so for any section of a boll



Cotton Picking Machine of the «SOUTHERN COTTON PICKER COMPANY».

to enter the brushes. This system will not pick either dry or green leaves unless small particles of leaf should adhere to the back of cotton when it is picked.

It is made for one man to handle in the field.

Being constructed of iron, steel and aluminium, it is light and durable. It is driven by less than half a gallon of petrol for 12 hours. Even in unfavourable soil conditions the machine picks an average of 60 lbs cotton per hour.

180 - **Dust Aspirator for Chaff-cutters, Fendt System.** — *Deutsche Landwirtschaftliche Presse*, 43rd. Year, No. 98, pp. 776-797, 2 figs. Berlin, 6 Dec. 1916.

This apparatus, constructed by Theodor Fendt, at Markt-Oberdorf (Bavaria) and patented in Germany under the name of "Staubsauger" (dust aspirator) is placed on both sides of the hopper into which the cut straw falls.

The cutting apparatus is enclosed within a cage *a*, either with closed wooden or canvas sides fastened to the support *b* either permanently or in such a way as to be removeable at will. Within the guard, beneath

the point *c* where cutting is effected, there is placed on each side of the hopper *d*, a dust aspirator *f* separated from this latter by a sieve or grating *e*. These two aspirators are mounted upon a common axle *g*, driven by the axle *i* of the cutting wheel, the action being transmitted either by means of a cord, chain or belt.

The dust removed from the cut straw through the sieves *e* is eliminated from the apparatus by the ventilators (aspirators) *f*, which force it

*Dust Aspirator for Chaff Cutters Fendt System.*

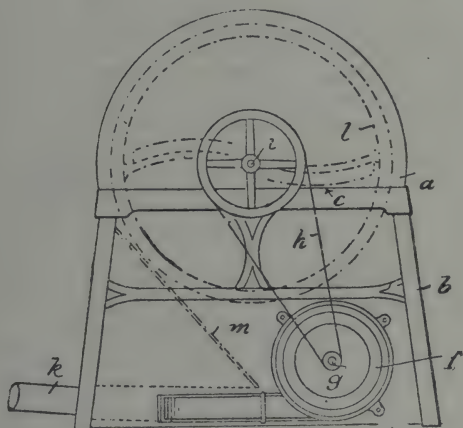


Fig. 1. — Side elevation.

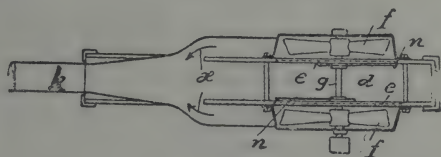


Fig. 2. — Plan.

along, in the direction indicated by the two arrows (fig. 2), into the tube *k*.

The chute *m* within the cage facilitates the passage of the cut straw to the aspirators.

The sieves or gratings *e* of each aspirator may be kept clean by means of a revolving brush or by an arm *n* working sufficiently near them so as to clean them by friction or by air current or shock. The cage *a* may be provided with one or more doors enabling the sieves to be reached and cleaned by hand.



## 181 — Review of Patents.

*Tillage Machines and Implements.*

Canada	171 829 Weeder. 171 952 Cultivator. 171 971 Plough. 172 066 Cultivator disc mountings. 172 070 — 172 145 Harrows.
Denmark	21 621 Harrow with device for controlling the depth of the teeth. 21 638 Device for lifting the shares of a motor plough.
France	480 821 Digging drum for agricultural implements. 480 942 Motor plough. 480 971 Tractor for agricultural use.
Netherlands	1 671 Motor plough.
United kingdom	12 191 Motor plough.
United States	1 200 107 Motor gang-plough. 1 200 967 Weeder with bent teeth. 1 201 296 — 1 201 649 — 1 201 950 — 1 202 563 — 1 203 104 Ploughs. 1 201 398 — 1 201 399 — 1 201 982 — 1 202 394 — 1 203 043 — 1 204 287 Cultivators. 1 201 547 Harrow. 1 201 644 Gang plough. 1 202 947 Tractor plough.

*Manures and Manure distributors*

British India	2 639 Improved fertiliser. 2 709 Process for obtaining from peat a product useful to agriculture and horticulture.
Canada	172 044 Manure loader.
France	480 697 A soluble and assimilable phosphatic manure and methods for its manufacture.
Switzerland	74 095 Apparatus for spreading calcium cyanamide or other finely divided fertilisers.

*Drills and Sowing Machines, etc.*

United States	1 200 232 — 1 202 658 — 1 204 329 Sowers. 1 201 065 Stalk Cutter. 1 201 447 Potato planter. 1 203 713 Sweet-potato digger.
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*Control of Diseases and Pests of Plants.*

France	480 770 Spraying machine for cryptogamic diseases of the vine.
United Kingdom	11 951 Spraying machines.

*Reapers, Mowers and Harvesting Machines.*

British India	2 654 Improvements in harvesters.
Canada	172 060 Bean Cutter.
United kingdom	12 503 Hay maker.
United States	1 200 455 Binding Mechanism. 1 200 983 Sickledrive for harvesters. 1 201 438 Traction-binder.

- I 201 508 Bean cutter.
- I 202 084 Lifting guard for Harvesters.
- I 203 954 Maize harvester.
- I 204 319 Attachment for grain-binders.
- I 204 328 Kafir-corn harvester and binder.

*Machines for Lifting Root Crops.*

- Denmark 21 631 Machine for lifting tubers and roots.
- United States I 201 280 — I 203 345 Beet Harvesters.
- I 201 567 — I 202 737 Potato Harvesters.
- I 203 713 Sweet-potato digger.

*Threshing and Winnowing Machines.*

- British India 2 659 Paddy thresher.
- Canada I 72 020 Grain Screen.
- United States I 201 484 Attachment to Grain-separators.
- I 202 007 — I 203 047 — I 204 139 — I 204 183 Grain-shocking machine.
- I 202 486 Green-Pea hulling machine.
- I 202 762 Threshing machine.
- I 203 760 Vibratory Straw-carrier.

*Machines and Implements for the Preparation and Storage of Grain, Fodder, etc.*

- British India 2 668 Method and apparatus for preserving fruits, legumes, seeds, and other vegetable products.
- Canada I 71 706 Cutter for Grain Separators.
- I 71 864 Grain Elevator.
- Switzerland 74 220 Device for washing cereals.
- United Kingdom I 01 769 Portable Elevator.
- United States I 201 376 Baling press.

*Steering, etc. of agricultural machinery.*

- France 480 971 Motor Tractor for agricultural use.
- United States I 201 432 — I 202 095 — I 203 364 — I 203 783 — I 204 299 Tractors.
- I 204 225 Self-propelled agricultural implement.

*Feeding and Housing of Livestock.*

- Canada I 71 683 Animal release device.
- Switzerland 74 097 — 74 192 Pig troughs.
- 74 098 Device for attaching a halter chain.
- 74 191 Automatic water trough for cattle.

*Aviculture.*

- Canada I 71 734 Feeder for poultry.
- France 481 043 Improved brooder.
- Switzerland 74 099 Grinder for poultry food.
- 74 124 Process for preserving eggs.
- United Kingdom I 2 539 Poultry pen.

*Apiculture.*

- Denmark 21 654 Hive with movable independent shelves.

*Dairying.*

Canada	171 851 Teat cup.
Switzerland	74 122 Portable milking machine.
United kingdom	12 117 Milking machine.

*Farm Buildings.*

Canada	171 703 Fence Post.
	171 781 Stall for animals.
	171 846 Farm Gate.
	172 112 Windmill.

*Various.*

Canada	171 794 Peat Manufacture.
Netherlands	1 658 Process for making margarine.
United Kingdom	11 950 Steam cooker.
	12 283 Garden labels.
	12 482 Basket.

## RURAL ECONOMICS.

## 182 - Influence of Age on the Value of Dairy Cows and Farm Work Horses. —

McDOWELL, J. C. in *United States Department of Agriculture, Bulletin No. 413* (Office of Farm Management), pp. 1-12. Washington, August 24, 1916.

The Office of Farm Management of the United States Department of Agriculture has published the results of the information it has obtained concerning the influence of age on the values of dairy cattle and farm work horses.

The dairy cows of each breed were divided into 4 classes, (see Table I.) For each class of dairy cows of the Holstein, Guernsey, Jersey, and Ayrshire breeds the data presented in the percentage table (Table I) are given in graphic form.

All classes of live stock vary in actual value from time to time, but such variation does not greatly affect the relative value of the animal at different times. A cow worth \$100 at 3 years of age, when there is a great demand for dairy cattle, will be worth less when there is smaller demand, but there will be a corresponding fluctuation in value for all ages. It is, therefore, believed that the percentage table will be found useful in determining relative value according to age. It is interesting to note some differences in prices owing to the distribution of the breeds. Thus, Holstein calves and old cows are valued relatively higher in the Central State than in the East. This is doubtless due largely to the lower price of feed in the North Central States. During their years of highest production, the price of Holstein cows appears to average a little higher in the Eastern States. This difference, however, is not marked, and in the cases of the \$100 grade cow, it is reversed.

Guernsey calves and old cows, like those of the Holsteins, are cheaper in the East than in the central West. In the case of pure bred in their prime, however, the reverse is true.



TABLE I. — *Influence of Age on Value of Dairy Cows, Shown in Per Cent of Maximum Value.*

Age	Class I Grade cows worth \$ 80 at 3 years of age				Class II Grade cows worth \$ 100 at 3 years of age				Class III Purebred cows worth \$ 200 at 3 years of age				Class IV Purebred cows worth \$ 300 at 3 years of age			
	Guernsey		Jersey		Holstein		Jersey		Guernsey		Ayrshire		Holstein		Guernsey	
	Holstein	Jersey	Ayrshire	Holstein	Guernsey	Jersey	Ayrshire	Holstein	Guernsey	Jersey	Ayrshire	Holstein	Guernsey	Jersey	Ayrshire	Holstein
Birth. . . . .	10 %	11 %	11 %	9 %	10 %	10 %	10 %	10 %	24 %	22 %	18 %	17 %	26 %	23 %	17 %	18 %
6 months . . .	24	24	24	20	21	21	21	21	34	33	27	27	36	34	25	27
1 year . . . .	38	40	38	36	35	36	35	35	46	45	41	39	48	48	38	38
2 years . . . .	60	62	62	57	57	60	59	59	62	63	61	57	66	67	59	58
3 years . . . .	78	81	87	81	79	83	81	78	78	78	80	76	86	86	85	82
4 years . . . .	89	92	94	88	92	92	90	91	91	90	91	88	94	95	94	91
5 years . . . .	98	100	98	96	99	98	97	98	98	98	98	97	99	100	99	97
6 years . . . .	100	100	100	100	100	100	100	100	100	100	100	100	100	99	100	100
7 years . . . .	97	97	98	99	95	98	98	96	96	96	96	98	95	95	94	97
8 years . . . .	91	91	94	95	88	87	93	89	89	89	90	93	87	88	87	91
9 years . . . .	82	83	82	90	78	76	84	86	80	79	79	85	76	78	76	81
10 years . . . .	74	74	77	79	68	67	74	77	69	70	68	75	64	67	63	68
11 years . . . .	66	65	66	71	59	56	64	67	59	59	55	63	55	57	51	57
12 years . . . .	59	56	56	62	51	48	53	59	50	49	45	51	45	47	40	46
13 years . . . .	51	48	47	52	47	39	43	50	41	39	35	39	35	37	30	35
14 years . . . .	43	42	39	45	39	32	34	41	32	30	26	30	27	28	21	24
Number of estimates.	107	101	144	137	159	103	134	141	114	70	137	79	148	115	96	59

Jersey calves are also relatively cheaper in the Northeastern States. Ayrshire calves and old cows are cheaper in the Northeastern States than in the North Central States, while Ayrshire cows, during their period of highest production, fetch a little higher prices than in the east.

The influence of age in the value of farm work horses is shown by Table II. The maximum value, \$250, is reached at some point between 6 and 7 years of age.

TABLE II. — *Influence of Age on Value of Farm Work Horses: shown in % of Maximum Value.*

Age	Max. Value \$ 250	Per cent of maximum value	Age	Max. Value \$ 250	Per cent of maximum Value
		Per cent.			Per cent.
Birth . . . . .	\$ 39	16	9 years . . . . .	227	91
6 months . . . . .	63	25	10 years . . . . .	209	84
1 year . . . . .	96	38	11 years . . . . .	190	76
2 years . . . . .	142	57	12 years . . . . .	174	70
3 years . . . . .	185	74	13 years . . . . .	154	62
4 years . . . . .	220	88	14 years . . . . .	137	55
5 years . . . . .	242	97	15 years . . . . .	119	48
6 years . . . . .	248	99	16 years . . . . .	101	40
Maximum . . . . .	250	100			
7 years . . . . .	241	99	Number of esti- mates . . . . .	147	—

As is seen, there is little change in value between the ages of 5 and 9.

## AGRICULTURAL INDUSTRIES.

INDUSTRIES  
DEPENDING  
ON PLANT  
PRODUCTS

183 — **Practical Method for Removing the Foxy Flavour from Noah Grapes** (1). — TISSÈDRE, L., in *Le Progrès agricole et horticole*, 33rd. Year, No. 45, pp. 442-443. Montpellier, Nov. 5, 1916.

The writer possesses some Noah grape stocks all derived from 2 cuttings found in 1883, in a consignment of plants from Missouri, U. S. A. The following are the chief characters: wood, red, stout, very long, rough to the touch, similar to the York-Madeira — internodes at an average distance apart — leaves enormous and sea-green in colour — grapes above average size with very big seeds — clusters dense, often winged — taste strawberry flavoured but not too pronounced. Grows well from cuttings.

(1) See also *B.* 1916, No. 555.

(Ed.)

For the last 4 years the writer has used the following method for obtaining wine without fox: The grape juice after leaving the press is placed in fermenting casks. These casks were never completely filled: a space varying from 5 to 10 cms was always left. A hole is then drilled in the bottom of the cask at the level of the liquid so as to establish an air-current with the open bung-hole: the liquid was then allowed to ferment. The elimination of the foxy flavour takes place automatically and when fermentation is completed the wine is devoid of any appreciable American flavour and may be placed on the market.

In a note accompanying the present article Prof. L. RAVAZ remarks that if *one* drill-hole already gives such a satisfactory result then the result of drilling *two* holes should be better still. The disappearance (or attenuation) of the odours causing the "foxy" flavour during the process under notice is possibly due to accompanying oxidation phenomena.

184 - **Compulsory Degerming of Maize in Hungary** (1). — KÖZTELEK, Year 26, No. 45, pp. 1588-1590. Budapest, Nov. 4, 1916.

A Government Order dated Nov. 1, 1916 imposes obligatory removal of the germs from maize grains and gives the rules to be adopted for effecting the same. The order further contains measures for regulating the trade in maize germs, extraction of oil, sale and maximum prices. According to the provisions of this order all stone mills and establishments for the milling of maize are obliged to remove the germs and to carry all operations according to the instructions of the "National Union of Credit". The mills may not extract more than 12 lbs. of germs per 100 lbs. of maize, and the quantity of oil expressed must be at least 15 lbs. per 100 lbs. of germs. This order only concerns stone mills, especially those which, thanks to the aid of the above mentioned Union are in a position to complete the alterations which the Union requires for the process in question.

Every holder of maize must inform the "National Union of Credit" in writing of the amount of stock he holds. Stone mills and other establishments for milling maize are obliged to signal the quantity of germs produced, twice a month, *viz*: on the 5th and 20th days at latest and to make a special declaration whenever the quantity produced reaches 100 quintals (197 cwt.). In this connection the Union has the power to hold the establishments in question under permanent supervision (art. 2).

The stocks of maize of which the returns have been made are to be seized immediately the present order comes into force, and the supplies of germs may be sold by the owners solely to the said Union. In this way the Union on behalf of the Treasury, becomes the sole holder of the stocks of maize germs throughout the whole of Hungary (art. 4).

For the stocks of germs, the samples of which when examined by any designated Chemical Station must contain at least 15 % of oil, the above Union undertakes to pay the following prices per kilo (2.2 lbs) 62 heller (6  $\frac{1}{4}$  d.) to all commercial establishments and any other enterprises including those for the fattening of live-stock not attached to farms:

(1) See also: B. 1916, No. 1017.

(Ed.)



102 *heller* (10  $\frac{1}{4}$  *d.*) to millers who degerm the maize of the producers required by these latter for the use of their families, servants and farm generally. This price includes carting to the place of unloading but not the cost of the sack. If the oil content exceeds 15 %, the price paid must be 1 *heller* ( $\frac{1}{10}$  th. of a penny) for every unit of percentage in excess; on the other hand, for every unit of percentage short of this standard 2 *hellers* shall be deducted.

All mills and such other establishments already mentioned are obliged to degerm the maize of the grower, with or without his consent even when required for personal use on his farm, but he shall be entitled to an indemnity on the following scale :

- 1) Milling of the degermed maize shall be gratis.
- 2) In exchange for the germs extracted the aforesaid mills and establishments shall pay a sum equivalent to the value of an equal quantity of maize viz 3 *kronen* per quintal (1s. 3*d.* per cwt) (2).
- 3) Further, the said mills shall pay the producers an indemnity of : 3 *kronen* per quintal of treated maize (art. 7).

The transport of maize by rail, water or motor is not permissible without a special certificate issued by the " National Union of Credit " art. (8).

The said Union distributes the stocks of germs declared by the mills among manufacturers possessing the necessary plant for the extraction of oil (art. 9).

These factories receive, per 15 % of oil expressed, 18 *kronen* per quintal (7 s. 7 *d.* per cwt) of germs (art. 10).

In virtue of the present Order, all oil stocks are requisitioned and manufacturers are obliged to hand over the oil they produce to the Union, which in its turn will re-sell it to the Central Hungarian Society of Fats and Oils at the price of 1000 *kronen* per quintal (1) (£ 21. 3s. 4*d.*) (art. 11, 12 and 13).

This Limited Society is concerned with the marketing of the oil and is authorised to demand, over and above the price paid to the Union of Credit, a share of profit fixed by the Minister of Commerce. The retail selling prices are also fixed by the same Minister (art. 14 and 15).

Infringements entail severe punishment and a fine not exceeding 2000 *kronen* (£ 83. 6s 8*d.*) may be inflicted. Stocks held up or undeclared are seized by the authorities. This Order comes into vigour the 1st November 1916 (art. 16-21).

The obligation to remove the germs from maize can only be imposed on growers who send their produce to mills or factories for this purpose. When they do so, however, they have the right to claim an indemnity as mentioned above.

185 - **New Process for Extracting the Oil from the Kernels of Stone Fruit.** — ALPERS, K., in *Chemiker Zeitung*, 40th. Year, No. 91-92. pp. 645-646. Cöthen, 1916.

According to the census of 1900, Germany possesses 21.5 millions of cherry trees and 69.4 millions of plum trees. According to statistics

(2) All conversions of Austrian money in this article are based on par value.

(Ed.)

on this subject and to the calculations of the writer, the cherries give 5 %, the plums and apricots 10 % of stones. The stones of cherries give about 30 % of kernels, those of prunes 15 %, and those of peaches about 7 % ; the kernels of cherries contain 36 % of oil, those of plums 42 %, those of apricots and peaches 47 %. These figures only apply to good, picked kernels, the actual total yield of oil would be less but it is permissible to assume that in Germany, in good years, several millions of pounds of oil might be extracted from the kernels of stone fruit. Unfortunately, this source of oil is not exploited in Germany owing to the lack of good machinery for crushing the stones and because the separation of the kernel involves considerable trouble. Recently, the firm of MARTIN of Bitterfeld has constructed a machine which crushes the stones extremely well. For separating the kernel from its shell the writer has discovered a method based on the specific gravity of these two portions. The sp. gr. of plum kernels is about 1.05, that of their shells 1.18. For cherries, apricots and peaches, the ratio between the sp. gr. of the kernel and that of the shell is about the same. By using a magnesium chloride solution with sp. gr. equal to 1.15 the two portions may be separated with ease. The kernels float the solution while the stones fall to the bottom. The kernels are then dried, stripped and pressed.

The method is well adapted for large quantities of stones. The writer has experimented chiefly on plum stones but trials with those of peach and cherry were equally satisfactory.

The oil obtained produced no hydrocyanic acid ; it was slightly turbid at first but gradually cleared. The taste from being pleasant at first, gradually became somewhat bitter, strongly resembling that of the oil from bitter almonds. It does extremely well as salad oil. Heated to 160° C. or kept for 2 weeks in an open bottle, it lost its characteristic odour.

The method is being perfected.

186 - **Some New Constituents of Milk. The Distribution of Phosphatides in Milk.** — OSBORNE, THOMAS B. and WAKEMAN, ALFRED J., in *The Journal of Biological Chemistry*, Vol. XXVIII, No. 1, pp. 1-9. Baltimore, Md., December, 1916.

In a preceeding paper (*The Journal of Biological Chemistry*, Vol. XXI page 539, 1915) the writers have shown that the alcoholic washings of the coagulated protein obtained by boiling the filtrate from casein of cow's milk yield to alcohol a small quantity of monoamino- and diamino-phosphatides. They have now examined the alcoholic washings of casein and have found that these likewise contain a small amount of similar, if not identical, phosphatides. They have also extended their investigation to the other parts of milk in order to learn as much as possible about the distribution of phosphatides in milk.

The results of this examination have lead to the following conclusions:

Alcohol removes from milk casein, precipitated by diluted hydrochloric acid, about the same amount of phosphatides as was previously obtained from the "lactalbumin", the proportion of phosphatide which it yields is correspondingly less.



The precipitate produced by treating skimmed milk, freed from casein and heat-coagulable proteins, with sodium hydroxide until neutral to phenolphthalein contains a very small amount of the same phosphatides and fatty substances that can be obtained from the alcoholic washings of the heat-coagulable proteins (« lactalbumin »). The non-protein fractions of fat-free milk contain at the most only minute traces of phosphatides. The total amount of phosphatides obtained from 1 litre of whole milk was equal to about 27 mgms.

Phosphatides are intimately associated with the protein constituents of milk and possibly are combined with them as "lecithalbumins".

**187- The Dairying Industry of England and Wales.** — GAVIN, W. and MACKINTOSH, J. in *The Journal of the Board of Agriculture*, Vol. XXIII, No. 6, pp. 593-597. London, September 1916.

Supplement No. 16 of the present number of the Journal of the Board of Agriculture contains two papers which, together, constitute a valuable survey of the dairying industry in England and Wales.

The first paper, by W. GAVIN, opens with an historical survey of the dairying industry in the last halfcentury, and draws attention to the rapidly increasing volume of the fresh milk trade.

The number of cows and heifers in England and Wales increased from 1 952 648 head in 1881-1885 to 2 484 220 head in 1914; an increase of some 30 per cent., as against an increase in the population of the country of 60 per cent since 1871.

The greatest increase in dairying has occurred in dairying districts.

The author next deals with the railway milk traffic of the various railway companies, with special reference to the London milk trade. The figure obtained for the total railway milk traffic of London is 91 700 000 galls, and this, added to a road traffic of 15 000 000 galls and the produce of London dairies — 1 200 000 galls — gives the total milk supply of London as approximately 108 000 000 gal.

The midland towns of Lancashire, Cheshire, Warwick, Stafford and the West Riding take something over 50 000 000 galls the North-East Coast takes 11 000 000 galls., the South Wales mining area 4 000 000 galls, the South-East Coast and district 4 500 000 galls, and the South Coast 5 750 000 galls.

With 92 000 000 galls, taken to London and 100 000 000 galls elsewhere, the total handled by English railways does not exceed 200 000 000 galls.

The total consumption of milk was estimated as 731 000 000 galls in 1908, so that about one quarter of the milk consumed in England and Wales is transported by railway.

Many consignments are made from great distances; in 1911 the G. W. R. brought 1549 churns from St. Erth, Cornwall, 320 miles to London, while the most distant point recorded by the L. & N. W. R. for London milk traffic is Toom (Ireland) 513 miles from Euston Station. A valuable summary of the railway traffic is given in an appendix in which the principal consuming and producing areas of the various lines are shown, where possible.

The share taken in the industry by the various countries, and the conditions obtaining in these countries are next considered. It is emphasised.



Class	Per Gallon of Milk			Per 100 lb of Milk			Per 1 lb of Butter-Fat		
	I	II	III	I	II	III	I	II	III
	d.	d.	d.	d.	d.	d.	d.	d.	d.
<i>Value of Manurial Residue and Gross and Net Cost of Food.</i>									
1. Gross Cost of Food . . . . .	4.83	3.72	4.14	46.89	36.11	40.19	12.34	9.50	10.58
2. Value of Manurial Residue . .	0.35	0.26	0.38	3.40	2.52	3.69	0.90	0.66	0.97
3. Net Cost of Food . . . . .	4.48	3.46	3.76	43.49	33.59	36.50	11.44	8.84	9.61
<i>Summary of Overhead Charges.</i>									
4. Labour . . . . .	1.60	1.30	1.42	15.53	12.62	13.78	4.09	3.32	3.62
5. Depreciation and Loss . . . .	1.47	0.37	0.73	14.27	3.59	7.09	3.75	0.94	1.86
6. Interest on Capital . . . . .	0.42	0.36	0.39	4.07	3.49	3.78	1.07	0.92	1.00
7. Depreciation of Dairy Utensils and Food Machinery; Oil and Coal, Veterinary Charges, Medicines and Sundries . . . . .	0.37	0.31	0.36	3.59	3.01	3.49	0.94	0.79	0.92
8. Keep of Bull . . . . .	0.22	0.18	0.20	2.13	1.74	1.94	0.56	0.46	0.51
Total . . . . .	4.08	2.52	3.10	39.59	24.45	30.08	10.41	3.43	7.91
<i>Summary of Transit Charges.</i>									
9. Keep and Depreciation of Milk Cob, Upkeep of Milk Cart, Railway Churns etc. . . . .	0.21	0.44	0.42	2.04	4.27	4.08	0.54	1.12	1.07
10. Railway Carriage . . . . .	—	1.04	0.78	—	10.10	7.57	—	2.66	1.99
Total . . . . .	0.21	1.48	1.20	2.04	14.37	11.65	0.54	3.78	3.06
Cost of production to the farmer .	8.78	7.46	8.06	85.12	72.41	78.23	22.39	16.05	20.58

1) that the basis of dairying in England and Wales is now the fresh milk trade; 2) that cheese-making, though still carried on in some districts, is generally speaking, only continued (a) in districts where lack of transport encourages it, or (b) as a means of utilising a surplus or flush of milk when prices are low; 3) that butter making, with the exception of that in the Cornish factories, is a rapidly diminishing industry in England and Wales.

On the basis of the figures given in the Board's report on the agricultural output of Great Britain, the total milk production of England and Wales is placed at 1 071 000 000 galls. With regard to the consumption of milk, that for the whole of England and Wales is placed at 22  $\frac{1}{4}$  galls, and that for London as 15 galls, per head. The paper concludes with a survey of the imports and exports of dairy produce.

The second paper, by J. MACKINTOSH, deals with the average costs, not merely of food in the production of milk, but also of various overhead charges and transit charges, the former including charges in respect of labour,

depreciation (on live and dead stock) interest on capital and keep of bull; and in connection with the cost of food due attention has been paid to the value of the manurial residues of the foods consumed. The farms to which the investigation related were situated throughout the county of Bucks and in parts of the counties of Berks, Oxford and Middlesex.

The costs are given for three different types of farms: Class I - Suburban farms; Class II - Farms almost entirely grass land with very little arable; Class III - farms chiefly grass land, but with a fair acreage of arable.

The following table shows for the three types of farms, the gross cost of food, the value of the manurial residue, the net cost of food, the overhead and the transit charges:

The division of the gross cost of food between the various kinds of foods is as follows:

	Roots	Hay	Straw	Wet Grains	Cakes & Meals	Pasture & Aftermath
	%	%	%	%	%	%
Class I . . . .	17,8	13,4	7,6	12,5	30,3	18,4
Class II . . . .	12,5	23,2	6,2	—	35,0	23,1
Class III . . . .	16,6	15,5	6,2	—	45,2	16,5

The average yields per cow were: from farms in Class I. 650 galls; Class II. 640 galls; Class III. 660 galls. In working out the above costs no charge was made for the supervision by the farmer or bailiffs. The paper concludes with a brief summary of the results obtained by other investigators. These figures, based on a small areas under the war conditions, cannot be regarded as of universal application, but are useful in supplying farmers with a method by which they can work out their own costs, and thus examine their practice closely where they find their costs exceeding the average figures given in the paper.

188 - **The Trade in Feathers in Brazil.** — REDONDO, A., in *Broteria, Serie de Vulgarização Scientifica*, Vol. XV, Fasc. 1, pp. 33-35. Braga, January 1917.

Among the feathers exported from Brazil there figure in the official lists: 1) those of "garça real" (*Ardea egretta*), "garça pequena" (*A. candidissima*) and "garça de cabeça preta" (*Nicticorax pileatus*); 2) those of "ema" (*Rhea americana*); among unspecified kinds occur those of "guarás" (*Endocimus ruber*) with red plumage; "colhereira" (*Ajaja Ajaja*) with plumage of a delicate rose colour, and many others.

The most highly valued feathers are those of "garça"; they are exported chiefly from the Southern States of the Brazilian Union: Pará, Amazonas, Maranhão, Piahy. Those of "ema", chiefly employed for the manufacture of boas are mostly exported from the States of: Bahia, Piahy, Maranhão, Ceará and Rio Grande do Sul. The "guará" are found in abundance in the Northern States and especially in the region of Amazonas, Pará and Maranhão.

The importing countries are, in order of importance: United States - France - Uruguay — England — Germany.

The appended Table gives the quantity and value of the export of feathers for the period 1910-1914.

*Exportation of feathers from Brazil during the 5 year period 1910-1914,*

Year	« Ema »		« Garça »		Not specified	
	Quantity	Value *	Quantity	Value *	Quantity	Value *
1910	3 893 kg	50 175 fr	126.292 kg	143 517 fr	571 kg	20 924 fr
1911	1 907	26 141	223.413	141 471	93	1 781
1912	5 249.5	80 185	78.500	70 405	14.24	3 548
1913	4 613	66 862	248.788	147 813	84.60	2 211
1914	3 069.5	47 789	120.968	108 155	28.56	2 352

\* The paper *milreis* has been taken as equal to 1.68 fr.

The trade in feathers is of a very precarious nature and is subject to considerable fluctuations from one year to another ; taken as a whole it is at present on the wane, for the export value in 1914 was only 158 296 fr. against 223 849 fr. in 1904.



## PLANT DISEASES

### DISEASES NOT DUE TO PARASITES OR OF UNKNOWN ORIGIN.

189 - **Tuberoid Deformities on Sunflower Roots in Italy.** — BÉGUINOT AUGUSTO, in *Atti e Memorie della R. Accademia di Scienze, Lettere e Arti in Padova*, Vol. XXXII, Part III, pp. 229-242. Fig. I-II. Padua. 1916.

In November 1914, the Author received from Porto Tolle (Venezia) some roots of *Helianthus annuus*, which showed many swellings presenting two widely different forms, even after microscopical examination.

The second form of swelling was only to be found on the secondary underground roots. it was cylindroid, rarely oval or irregular, varying from 1-2 mm. up to 3 mm. in diameter ; the deformities were placed along the axis of the root, less often on the tip, isolated or clustered ; in some cases, the whole of a short root was deformed ; then the swelling was longer, more bulky and because of the other roots, often irregular ; these swellings were rather flabby ; but the best developed ones resisted compression slightly, and appeared somewhat hardened. According to the size of the swellings they contained one or several females of a nematode belonging to the genus *Heterodera*, but which differed from *Het. radicicola* and *Het. schachtii*.

The writer has seen on material from Porto Tolle another deformity that appeared different from the previous one, both on naked eye and microscopical examination. It consists of larger swellings, of an average diameter of 3 to 6 mm. and a maximum diameter of 18 to 20 mm., placed at the tips of the roots, pyriform, less often rounded, never cylindrical, and quite woody in consistency. No nematode as observed in the first form nor other parasites were seen in the woody and largely vascularised tissues in the swellings. A large number of individuals of a species of *Rhabditis* (fam. *Anguillulidae*) were found adhering to the cortical parenchyma already investing the woody body and decomposing.

In order to ascertain if the cause of the second type of deformity had anything to do with the previous nematode, cultures of *Helianthus annuus* were started in the Botanical Garden of Padua, using seeds from

Porto Tolle. Control plants were chosen and the remainder were subjected to various traumatic actions (torsion, flexion, various wounds, defoliation, topping at various stages of development, etc.). Topping the plants resulted in a large series of morphological and anatomical deviations which are not described, as they more or less agree with those already obtained and illustrated by VÖCHTING, before him by KRAUS, WOLLNY and BERTHOLD. In some of the *Helianthus* plants grown at Padua and topped, the author observed, towards the end of October 1915, the presence of both hypogean and epigean tuberoid deformities; the latter which were absent for the Porto Tolle material had already been observed by VÖCHTING. As regards the hypogean swellings, the zone deformed (end of the roots), the average size, the form and woodiness of the plants obtained at Padua in topped plants agreed with the corresponding characters shown by the Porto Tolle material. No similar deformities were seen in the control plants or in other plants which had been submitted to traumatism other than topping during the vegetative period. The deformities were only found in some of the plants that had been topped.

No *Heterodera* was ever found in the sunflowers grown in the Padua Botanic Garden, no matter what the type of deformity was, if similar to that in the Porto Tolle material, although *H. radicola* had already been recorded as living on various plants growing in the same garden; on the other hand the decaying adult bark did not harbour the other nematode (*Rhabditis*) which was, on the contrary, very abundant in the original material. As *Helianthus* was grown at Padua on a sufficiently large scale, the absence of *H. radicola* shows that *Helianthus annuus* is not attacked by this nematode, and that where it is attacked, it probably is a different species or race. In addition the complete absence of eel worms shows that there is a different cause of the tuberised roots and further it is probable that the *Rhabditis* found in the Porto Tolle material should not be considered as a parasite.

The author concludes from his researches and observations that the deformity he has described can not be ascribed to a parasitic agent, and that it is difficult to regard the nutritive disturbance caused by topping as having no connection with the cause. Under natural conditions, mutilation and wounds caused by wind, hail, etc., are not rare; possibly the plants at Porto Tolle had suffered in this way.

Nevertheless, the writer is aware that his theory does not explain the fact that all the topped sunflowers did not show the same reaction and why the tuberoid deformity is not caused by traumatism other than topping.

190 - On a Disease of the Banana in the Saleyer Islands, Indian Archipelago. — RIJSS, A. B., in *Mededeelingen van het Laboratorium voor Plantenziekten*, No. 21, 16 pp., 1 Map, 6 Figs. Batavia, 1916.

A study of a disease that has devastated the banana plantations in some islands to the south of Celebes for some ten years. The disease is shown by an internal rot of the subterranean parts, which afterwards at-

tacks the flowering stem, and then the fruits, which show no external sign of disease for some time.

The dark red colour of the underground parts as seen on cutting them, is characteristic of the disease. The leaves remain normal for some time, but are attacked finally and the plant falls over.

The writer has found that the disease is very infectious and is spreading more and more in the surrounding islands. As certain varieties appear to be immune, it is advised to grow them and at the same time to rigorously prevent the passage of infected material into other countries.

## DISEASES DUE TO FUNGI, BACTERIA AND OTHER LOWER PLANTS.

### GENERALITIES

- 191 - **Fungi in the San Martino Valley (or Germanasca Valley), Piedmont, Italy.** — PEYRONEL BENIAMINO, in *Memorie della Reale Accademia delle Scienze di Torino, Classe di Scienze fisiche, matematiche e naturali*, Series II, Vol. LXXVI, No. 10, pp. 1-58, Figs 1-16, Turin, 1916.

This first systematic list of the fungi of the Valley of San Martino is a contribution to the study of the flora of the Vaudois valleys in Piedmont, which up to now is slightly known through the publications of FAYOL and FERRARIS. The list includes 362 species, varieties or forms of the true Fungi, together with 4 species of Myxomycetes.

With the idea of obtaining material for future study of the problems inherent to the biology of alpine mycological flora, the Author has not studied the whole of the Germanasca valley, but has limited himself to a careful study of a limited portion (districts of Ricalretto, Faetto and Prali) of the valley from 1911 to 1914.

Recorded as new to science are 3 genera, 14 species, and one form. There are also many fungi new to Italy, or interesting from other points of view.

- 192 - **Research work in the Laboratories of Agricultural Mycology and Entomology in the Belgian Congo.** — See pp. 178-179 of this *Bulletin*.

- 193 - **New Uredinaceae in East Africa.** — GROVE, W. B., in *Royal Botanic Gardens, Kew, Bulletin of Miscellaneous Information*, No. 10, pp. 269-272, 5 fig. London, 1916.

### Systematic description of:

(1) *Uromyces Polygalae* Grove, on leaves of *Polygala persicariaefolia* D. C., or a related species, in Uganda (Kipaya 4000 ft.) March 1916; the sori were infected with many pycnidia of *Darbuca filum* Cast;

(2) *Puccinia Erlangeae* Grove, on leaves of *Erlangea tomentosa* S. Moore, in British East Africa (Nairobi, Limoru 4000 ft.), February 1915;

(3) *P. exilis* Syd. var. *Hibisci* Grove, on leaves of *Hibiscus* sp., in Uganda (Kirerema 4000 ft.), March 1915;

(4) *P. Hoslundiae* Grove, on leaves of *Hoslundia* sp., in Uganda (Kipaya 4000 ft.), March 1915;



(5) *P. necopina* Grove, on leaves of *Tristemma* sp., in Uganda (Kipayo, 4000 ft.), March 1915;

(6) *P. pentadicola* Grove on leaves of *Pentas verticillata* K. Schum. var. *pubescens* S. Moore in Uganda (Mubango 4000 ft.), January 1915.

194 - Comparative Tests of Remedies against Vine Mildew (*Plasmopara viticola*), in Austria in 1916. — KORNAUTH, K. and WÖBER, R., in *Allgemeine Weinzeitung*, Year 33, No. 45, pp. 363-365; No. 46, pp. 371-374. Vienna, November 9 and 16, 1916.

MEANS  
OF PREVENTION  
AND CONTROL

As in the previous year, the Imperial Station at Vienna for the protection of plants has collaborated with the Austrian Wine-growers' Association in conducting comparative tests of sprays with and without sulphur, during the vegetative period, in order to determine their efficiency in controlling vine mildew. Trial plots belonging to the Imperial Station were utilised as well as the vineyards belonging to the provincial Schools of Feldsberg and Mistelbach and also to a private proprietor at Guldenfurth (Moravia).

The remedies used were:

I. — *Preparations using copper as a basis*. — Bordeaux mixture of various strengths; Burgundy mixture; "Bosna" copper paste of various strengths.

II. — *Copper sprays mixed with other preparations*. — Martini formula modified by the Imperial Agricultural Experiment Station at Gorizia; Bordeaux mixture with aluminium sulphate added; copper spray together with "Perozid", copper sulphur lime mixture.

III. — *Sprays without copper*. — "Perozid" in different strength; "Perfluozid I"; "Perfluozid II"; "Zinkpasta"; "Melior"; "Cumullit"; sulphur lime mixture; "Asra".

The "Bosna" copper spray contains 17.04 % Cu.; 16.98 % Cl.; 8.86 % Ca. and 44.7 % water. (The makers guarantee a content of 16.6 % copper).

The aluminium sulphate used in preparing the Bordeaux mixture together with aluminium sulphate, is simply commercial aluminium sulphate mixed with iron sulphate.

"Perfluozid I" is an acid fluoride of zinc, while Perfluozid II is a compound of sodium fluoride and fluosilicic acid.

"Zinkpasta" contains 9.23 % of zinc, and also hydrochloric acid, calcium and water.

The active constituent of "Melior" is parachlormetacresol; it also contains alum and soda. "Cumullit" also contains parachlormetacresol.

"Asra" contains  $\beta$ -naphthol.

The copper mixtures are prepared in the usual manner, while the solutions from the new preparations are made according to the instructions of the makers.

The only difficulties have been dissolving "Melior" and "Cumullit" and mixing "Zinkpasta" in a state of fine division with water.

The mildew was very prevalent both on the leaves and grapes in Austria during the year of experiments. The following are the conclusions arrived at by the writers:

1) The different sprays tested were sufficiently adherent in practice and did not damage the leaves.

2) Spraying with a 1 % copper spray does not give sufficient protection, especially for the grape, when the mildew is so extensive and early as in 1916. Only the stronger sprays (2 % Bordeaux mixture or 2 % "Bosna" cupric paste), applied 4 times, have preserved the leaves and grapes in a satisfactory condition.

3) The copper sprays with a varied proportion of lime which did best are those using 500 grm. of quicklime, thus about double the calculated amount of CaO for 1 kg. of copper sulphate.

4) The so-called Burgundy mixtures which have 1400 grm of crystal sodium carbonate to 1 kg of copper sulphate, do not injure the leaves, though they have been said to do so. The injuries observed by other writers are due to different causes and should not be blamed on the soda. A 1 per cent. Burgundy mixture was found to be more successful in these tests than 1 % Bordeaux mixture.

5) The "Bosna" copper paste acted very well, especially in preserving the grapes. The 1 per cent. mixture of this paste was found to be equal to 1 per cent Bordeaux mixture, even though "Bosna" only contained 17 % of metallic copper as compared with 25.4 % in copper sulphate. The defect that mixtures with "Bosna" paste deposit easily does not decrease its practical value, as the movement of the workmen keeps it sufficiently stirred up.

6) Economising copper sulphate by adding alum (as in the Martini mixture) or "Bodolidat" resulted in the observation that Martini sprays only containing about  $\frac{1}{2}$  % of copper sulphate are less efficacious than  $\frac{1}{2}$  % burgundy mixture. On the other hand they preserve the foliage better than the sprays containing "Perozid".

7) A  $\frac{1}{2}$  per cent. Bordeaux mixture to which  $\frac{1}{2}$  per cent. of "Perozid" had been added acted better than Martini mixture containing  $\frac{1}{2}$  % copper sulphate; the effect was not equal to that obtained by a 1 % Bordeaux mixture. On adding 2 % of "Perozid" to a 1 % copper solution the action of the Bordeaux mixture, otherwise ineffective, is increased so well as to give the same results as a 1 % Bordeaux mixture. This mixture acted much more vigorously than a Martini mixture containing  $\frac{1}{2}$  % copper sulphate and  $\frac{1}{2}$  % alum.

8) These experiments (in 1916) have again showed the fungicidal action of "Perozid", though it is not sufficient if the mildew becomes very serious. In case of mild attack in dry regions it acts satisfactorily on the mildewed leaves at any rate. On the basis of stoichiometrical calculations about 300 grms of CaO should be added to each kg. of "Perozid" and yet sprays made with half this amount of lime were found to be better than those containing the calculated amount of lime. Dusting "Perozid" as a powder over the lower parts of the plants simultaneously with or after spraying the vine stocks was found to be of no utility.

9) The 2 % sulphur lime mixtures with  $\frac{1}{2}$  % copper sulphate added

have an action proportional to the low copper content; they are found useless against both mildew and "oidium".

10) The various substances, paste of zinc, salts "Perfluozid" I and "Perfluozid II", sulphur lime sprays were insufficiently active, while "Melior," "Cumullit", and "Asra" were of no use at all.

195 - **Patents Relating to Means of Prevention and Control of Diseases and Pests of Plants.** — see *Review of Patents*, No. 181 of this *Bulletin*.

196 - **On the Spotting ("Puntatura") of Wheat Grains.** — LOPRIORE, G., in *Le Stazioni sperimentali agrarie italiane*. Vol. XLIX, No. 7-8, pp. 425-433. Modena, 1916.

In Lombardy, Italy, the name of "puntatura" (spotting) of wheat grains is applied to a condition characterised by a black spot limited to the outer face of the cotyledon. According to repeated observations of the writer, as well as information he has obtained, the spotting has been recorded from Molise, in Umbria, in the province of Ferrara, in Germany, in Sicily and in Basilicata (Campobasso) on a large number of varieties but with varying intensity ("Carosellone", "Realforte", "Ohio", "Scorzonera", "Triminia", "Cignarella", "Bianchetta", "Carosella rossa", "Gentil rosso", etc.) Hard wheats are more liable than soft wheats to this affection which appears to be due to the presence of *Cladosporium herbarum*.

The agriculturists of the province of Ferrara, Molise and Sicily, where the spotting is most frequent, do not consider it as injurious. Infected grains are often better samples than normal grains, and in the province of Ferrara it is held to indicate perfect maturity. Again, germination tests carried out by PEGLION, D'IPPOLITO and the Author have shown the spotted grains germinate normally. It remains to be ascertained how the fungus, which does not enter the tissues of the young plant, and causes no visible damage, is finally found close to the germ in the best developed grains.

197 - **A Peronospora Disease of Maize (Zea Mays).** — RUTGERS, A. A. L., in *Mededeelingen van het Laboratorium voor Plantenziekten*, No. 22. 30 pp., 7 plates, Batavia, 1916.

Of this disease, known as "Omo Lyer" in the vernacular and caused by *Peronospora Maydis* Rac., the writer gives the following summary:

1. The "Lyer" disease is the most serious disease of maize in Java. It has been present in Java for at least 25 years and has been found all over Java and Madoera and in Atjeh. It has never been found at an altitude of more than 4000 feet.

2. The symptoms of "Lyer" disease are different according to the time of infection. Plants attacked when young, are thin, with narrow leaves and quite yellow; when infection has taken place later, the plant is developed normally, but the leaves are striped with yellow in a typical manner. Diseased plants of the first type soon wither and die, usually collapsing; plants of the other type in a few cases even give some ripe seeds.

3. The "Lyer" disease is caused by *Peronospora Maydis* Rac. a true *Peronospora* and not a *Sclerospora*. The fungus described by RACI-



BORSKI is the same one; only his figures are rather incorrect. The fungus described by BUTLER, causing a disease with nearly the same symptoms, is not identical, but rightly put in the genus *Sclerospora*,

4. *Peronospora Maydis* Rac. has not only conidia, but chlamydospores and cöspores as well. Both are formed in decaying parts of the young plants, especially in the leaf sheaths.

5. Infection experiments by RACIBORSKI have proved that young plants can be infected by conidia. It is doubtful if this occurs normally in the field, as even plants of the same plant hole do not infect each other as a general rule.

Infection experiments with infected soil gave a negative result. In one case, seed of diseased plants gave diseased plants (4 out of 5 seeds); in a second experiment with 50 seeds only healthy plants were obtained.

Soil disinfection experiments with  $\text{CS}_2$ ,  $\text{NH}_3$ ,  $\text{KMNO}_4$  and formalin gave negative results.

Seed disinfected with hot water ( $60^\circ \text{C}$ ) gave twice as many diseased plants as control seed, probably because the hot water had a weakening effect upon the seed.

198 - ***Verticillium albo-atrum*, Causing the Verticillium Disease of the Potato in Ireland** (1). — PETHYBRIDGE, G. H., in *The Scientific Proceedings of the Royal Dublin Society*, New Series, Vol. 15, No. 7, pp. 63-92, Pl. II-III, Dublin, 1916.

The disease caused by *Verticillium albo-atrum* Reinke and Berthold (Verticillium disease of the potato) is one which results in the more or less premature death of the plant, the general symptoms exhibited being those of a process of gradual desiccation.

The mycelium of the fungus *Verticillium albo-atrum* R. and B. is found in the wood vessels of all parts of affected plants. It passes into the wood vessels of the new tubers, and from these again in the great majority of cases, into the plants which develop from them. Hence the disease is transmitted by means of infected tubers. The fungus in the tuber is not necessarily strictly localized at or near the heel-end, as previous authors (REINKE and BERTHOLD, SPECKERMANN) have supposed.

The fungus grows well in pure culture as a saprophyte, and infection experiments on healthy plants carried out with pure cultures were successful in reproducing the disease.

The disease was, to some extent at least, formerly covered by the terms "Curl" and "Leaf-Roll", but it is now to be removed from this category, and to be regarded as a specific type of those diseases in which the wood vessels become infested with fungus mycelium and for which the general term *hadromycosis* is suggested.

The disease does not appear to be very common in the British Isles, and the losses due to it are at present probably not large: but should it become prevalent, the losses might be severe. The most satisfactory preventive measures are to maintain a proper rotation of crops, and to take steps to ensure that the potatoes used for seed purposes are healthy.

(1) See also *B. May* 1912, No. 854.

(Ed.)

199 - **The Influence of Parasitic Fungi on the Clover Crop.** — ЛОБИК А. И. (ЛОБИК, А. И.), in *Болѣзни растений, вѣстникъ Центральной Фитопатологической Станціи Императорскаго Ботаническаго Сада Петра Великаго* (Diseases of Plants, Bulletin of the Central Phytopathological Station of the Peter the Great Imperial Botanic Garden), No. 4-5, pp. 115-130. Petrograd, 1915.

In 1915, the Department of Agriculture asked the writer to study clover diseases in the Riasan district. The work was started about the middle of May and finished towards the end of August. The facts obtained were worked out at the Central Phytopathological Station of the above Botanic Garden. In a preliminary note, the author gives the results of his work regarding the influence of parasitic fungi on the yield of forage and states that he will complete the work by giving information as to the seed. The work was carried out in six places where clover was grown on a large scale. At each place, plots of 41 to 72 sq. metres were chosen, and in each of the plots a line of 50 to 60 feet of clover was marked in May, that is, when it is usually impossible to observe the development of parasites. Each plant was numbered, enabling individual observations to be kept. The condition of the plant at the beginning of the observations was noted down as well as subsequent observations, such as: 1) the number of stalks; 2) the number of flower heads per plant; 3) the number of flower heads per stalk: a) the total number; b) the number of infertile flower heads; c) the number of cells attacked by the parasite; 4) the characters of the stem disease; 5) the height of the plant. At the end of the work when cutting was being commenced, notes were taken on: 6) the total weight of the plant; 7) the weight of the flower heads of the plant (when the air is dry). Thus for each plant was known the time when the disease appeared, the rapidity of its development, etc. The degree of development of the disease on stems and leaves was also noted, while taking the area attacked into account when grouping the results.

The seven following parasites were observed during summer on the clover; *Peronospora Trifoliorum* De By; *Uromyces Trifolii* (Hedw.) Lev.; *Erysiphe Polygoni* D. C., *Gloeosporium caulivorum* Kirchn.; *Phyllacora Trifolii* (Pers) Fckl., *Botrytis anthophila* A. Bond (1); *Phyllosticta Trifolii* Rich. At the beginning of June the most advanced parasite was *Gl. caulivorum*; *U. Trifolii* came up later and *Erys. Polygoni* only developed in August. The other parasites were only observed in isolated cases.

The influence of the parasites on the clover crop gave the following average figures grouped in a table:

From this table it is deduced that if the figures for the plants attacked by *Phyll. Trifolii* and *Erys. Polygoni* are not much different from those for healthy plants, the difference is great when the parasite is *Gl. caulivorum* or *U. Trifolii*: negative in the former and positive in the second. In the first case, even if the disease is not strongly developed, the loss of green matter is very considerable. According to approximate calculations, allowing that the average crop of clover hay should be 36

(1) See B. Oct. 1914, No. 955.

(Ed.)



	Healthy Plants	Plant attacked by <i>Phyllactora Trifolii</i>	Plant attacked by <i>Erysiphe Polygoni</i>	Plant attacked by <i>Gloeosporium caulivorum</i>	Plant attacked by <i>Uromyces Trifolii</i>		
					leaves slightly attacked	leaves strongly attacked	leaves and stems
Number of stems . . . . .	7.7	7.2	6.6	8.1	13.2	17.5	12.3
Number of flower heads . . . . .	23.9	23.2	29.2	13.7	53.8	79.2	65.6
Weight of the plant without flower heads, in grms . . . . .	7.2	6.2	6.5	4.7	18.1	23.6	15.5
Weight of the flower heads, in grms.	3.5	3.1	4.3	1.4	9.7	17.2	8.9
Weight of a single flower heads, in grms . . . . .	0.15	0.13	0.15	0.09	0.14	0.2	0.13
Number of plants examined . . .	51	25	48	133	21		

cwt. per acre, that of clover attacked by *Gl. caulivorum* is not more than 21.4 to 23 cwt per acre. Thus the control of this parasite should receive every attention. The figures relating to this fungus are supported by a sufficient number of observations (133) and in consequence, may be considered as approximately true, while for the other parasites, the number of observations is very limited. The figures for *U. Trifolii* have a certain relative value.

The last 3 columns of the table show that all the figures for clover "rust" are higher than those of the healthy plant and that the degree of development of the disease has its effect on that increase. When the leaves are slightly attacked, the figures increase visibly; they are at the maximum when the leaves are badly attacked, and they decrease slightly when both leaves and stems are attacked simultaneously while still remaining higher than the figures for healthy plants. This increase can not be explained by chance and the phenomenon should be thoroughly studied.

According to the writer, the rust appears in June and is fully developed at the end of the same month; the external appearance of diseased plants does not in any way appear different from that of healthy plants until late in autumn when the rust appears plainly. No dead stems or flower heads were ever found on plants attacked by the fungus; no deficient development was even noticed. The attacked plants were actually taller, more bushy and had more abundant flower heads. The proportion of attacked plants was from 8 to 10 per cent; that of badly attacked plants not more than 0.5 to 1.0 per cent., which means that the resulting injury is not worth consideration.

The paper is completed by a list of the weeds in the clover fields of the Riasan Government (including 50 species) and by diagrams showing the increase in weight and dimensions of clover attacked by *U. Trifolii* and *Gl. caulivorum*.



200 - *Sclerotium Rolfsii*, Injurious to Tobacco, in Deli, Sumatra. — WESTERDIJK, T., in *Mededeelingen van het Deli Proefstation*, Year 10, Part II, pp. 30-40, Pl. I-II, Medan, 1916.

A new disease of tobacco at Deli (Sumatra) was discovered by the Author in 1914. The theory that the disease was caused by a fungus in the soil was confirmed by experiments which showed that the same disease produced the same effects in certain other plants and also in other countries, like Japan and North America. The parasite was identified as *Sclerotium Rolfsii*.

The disease shows a few weeks after transplanting by the leaves withering and is easily recognised by the white hyphal felt on the roots and the brown, sclerotia, some few millimetres wide. If the roots are not examined, the disease is easily mistaken for a disease caused by *Phytophthora* or certain Bacteria. The same fungus causes a disease of *Hibiscus cannabinus* and *Canavalia* sp. in Java, where the writer found a larger number of leguminosae attacked by *Sclerotium Rolfsii*.

The Author is of the opinion a disease of the sugar-cane, and previously described as "red rot" ("roode rot") is due to *Sclerotium Rolfsii*.

These researches were confirmed by infection experiments with mycelium obtained from a pure culture of *S. Rolfsii*.

The writer discusses the difficulty of dealing with the parasite buried in the soil and suggests that the only method is to eliminate from the tobacco plantations all plants subject to attack by this *Sclerotium*.

201 - *Bacterium campestre* Injurious to Crucifers Cultivated in South Africa. — DOIDGE, E. M., in *The South African Journal of Science*, Vol. XII, No. 10, pp. 401-409, fig. 1-3, Pl. 8-II. Cape Town, 1916.

The Author has recorded *Bacterium campestre* (Pam.) Sm., as occurring in South Africa. For several years cultivated crucifers were often observed to be suffering from a disease similar to that produced by this bacterium and described by ERWIN F. SMITH under the name of "black rot of cruciferous plants", which he considered as only occurring in Europe, America, and New Zealand.

The writer has identified the cause of the disease, and has found that the organism is very common in South Africa. It attacks cabbage, cauliflower, kohlrabi and swedes. The bacterium has been isolated from diseased tissues and a number of successful inoculations have been made with pure cultures. The organism was found on imported seed offered for sale in Pretoria, its presence being proved by inoculations. A summary of the characters of the South African organism is given by the writer, and they are found to correspond with those of *B. campestre*.

It is suggested that, as a precautionary measure, all seed of cruciferous plants be disinfected before planting by immersing for 15 minutes in formalin (1:240) or in corrosive sublimate (1:1000)

202 - *Botrytis cinerea*, a Disease Attacking the Shoots and "Fruit" of Fig Trees in England. — BRIERLEY, WILLIAM B. in *Royal Botanic Gardens Kew, Bulletin of Miscellaneous Information*, No. 9, pp. 225-229. Pl. VIII-IX. London, 1916.

When examining a number of fig trees growing in a garden at Mortlake, it was noted that those which showed much "fruit" affected by rot due to *Botrytis cinerea* Pers. were also affected with a die-back of the young green shoots, whilst this was practically absent from trees bearing healthy "fruit". On the dead shoots were pustules of *Botrytis conidiophores*.

*Botrytis* conidia were transferred by means of a penknife blade to the apical pore of 6 figs of almost mature size. Of these, 3 were inoculated with spores from a dead shoot, and 3 from spores from a diseased "fruit". The conidia were placed in the pore which was dry, and care was taken to avoid injury. A fortnight later, all the inoculated figs were diseased, whilst no others on the same tree were found affected.

In a similar manner, spores were transferred from diseased figs and dead shoots, to living shoots and placed in excisions made in the twig, in leaf axils, and in the apical bud. Other shoots were similarly cut, but not inoculated, to remain as checks. In every case where the spores were inserted in a wound, the shoots were killed and pustules of *Botrytis conidiophores* were formed. On the other hand, shoots which had been merely wounded, or inoculated on unwounded surfaces, remained perfectly healthy.

The experimental figs and shoots were examined, and with the exception of one shoot, *Botrytis* mycelium only was present in the tissues. The one exception gave rise to the fructifications of a species of *Tubercularia*.

Subsequently a large series of inoculation experiments with pure cultures of the *Botrytis* derived from Southampton and Mortlake were commenced; the results already obtained confirm those of the preliminary experiments.

After having described the growth of the fungus in pure culture, the writer gives an account of the course of the disease in the figs and shoots.

Infection may occur at any point, but usually the attack commences at the pore, and thence spreads rapidly till the entire "fruit" is enveloped in a grey mould of *Botrytis conidiophores*. During this time, the tissues of the fig undergo marked alterations in texture and colour, though the central cavity is usually free from mycelium. By the time the fig is completely enveloped, it has shrunk considerably in size and after a few weeks shrivels to a mummified condition. In this state it often hangs on the tree during the winter, and in early summer, gives rise to abundant conidiophores.

Conidia taken from such "mummies" which had overwintered on the tree, proved readily capable of reproducing the disease on both healthy shoots and figs.

When a shoot is inoculated, the mycelium at first tends to spread equally in all directions and rapidly encircles the shoot. It then slowly progresses upwards in the tissues and more rapidly downwards. The shoot above the diseased area soon dies and usually becomes shrivelled and brown. The growth of the mycelium seems to be confined to the one season, so that it does not advance from the dead shoot further into the tree the following



year. The mycelium is chiefly found in the cortex of the shoots and the hyphae penetrate the tissues rapidly in all directions. They do not appear to exert the same destructive action upon the cell walls as was noted in the fruit, but the cells are killed and collapse.

In certain of the shoots the fungus remains alive during the winter, and gives rise to successive crops of conidia the following year. Such conidia are capable of reproducing the disease when inoculated into shoots and figs.

It is evident that the fungus is carried over the winter in the mummified "fruits" and dead shoots, and therefore these two sources of infection should be carefully eliminated. Badly infected trees which have been so treated have entirely recovered and now bear healthy and full crops.

203 - **On the Black Rot ("Nerume" or "Marciume nero") of Chestnuts, in Italy.** —

PEYRONEL, BENJAMIN, in *Rendiconti della Reale Accademia dei Lincei, Classe di Scienze fisiche, matematiche e naturali*, Series 5, 1916, 2nd Half-year, Vol. XV, Part II, pp. 459-461. Rome, 1916.

The preservation of chestnuts is often seriously hampered by the production of a sooty black colour on the whole or part of the cotyledons of the achene, whence the names "nerume" (= blackness) or "marciume nero" (= black rot) given in Italy to this condition. The attacked chestnuts which then acquire a bad taste and become quite uneatable, cannot be distinguished externally from healthy ones: the shell (pericarp) is often intact and of normal colour.

In Italy, PEGLION (1905-1906) found in attacked fruits a mycelium relating to *Rhacodium cellare* Pers., from which, after cultivation on various artificial media, he obtained abundant conidia resembling the fructifications of *Cladosporium*, *Hormodendron*, *Cladotrichum*, etc. BAINIER (1908), in France, has obtained, on the contrary, from pure cultures on sterilised chestnuts and on liquorice, the same characters as those described by PEGLION; but which after a couple of weeks, gave rise to a conidial form with no morphological affinity whatever with *Cladosporium*, *Hormodendron*, etc., and called by him *Harziella Castaneae*; this species, according to the writer, should be transferred, because of the type of its mycelium, from the family *Mucedineae*, to which the genus *Harziella* belongs, to that of the *Dematiaceae* and classed under a new genus, probably close to the genus *Stachyliidium*.

Because of the differences of opinion between PEGLION and BAINIER regards the conidial form, the writer first enquires if there is a single causal agent and whether the fungus studied by BAINIER is the same as that observed by PEGLION. In addition, without denying that storing chestnuts in cellars or damp warehouses, facilitates the development of the disease, the writer — from observations made in the vaudois valleys (Piedmont) — doubts that the infection really starts in those places, as PEGLION thinks.

As regards the entrance of the fungus into the fruit, since the pericarp is usually intact, it seems justifiable to suppose that infection takes place at the tip of the fruit, where lesions show more easily. But on cutting chest-



nuts not completely attacked by the fungus, it is at once seen that the alterations are produced on any part of the fruit.

If it is allowed that the fungus cannot penetrate the pericarp — a phenomenon as yet unexplained and which the writer considers improbable — it just be supposed that infection takes place at flowering when the fungus spores penetrate the ovary by way of the stigma, producing a fine mycelium which then develops in the ripe fruit, provided that latter is kept under the requisite conditions of moisture and temperature.

The Author, who is continuing the study of this disease, has obtained pure cultures on different media, with abundant production of mycelium which, at first silver-white, becomes grey, and finally olive colour; up to the present, however, these cultures have produced no fructification whatever.

### WEEDS AND PARASITIC FLOWERING PLANTS.

204 - *Emex australis*, a Queensland Weed. — BAILEY, T. F. and WHITE, C. T., in *Queensland Agricultural Journal*, Vol. VI, Part 6, pp. 373-374, Pl. 41. Brisbane, 1916.

The polygonaceous plant *Emex australis* is spreading considerably. The plant, originating from South Africa, is mentioned by BENTHAM in his "Flora australiensis", but with doubt, as a native of southern and western Australia; in fact, it occurs in all the eastern states. As far as Queensland is concerned, it was first recorded in 1911 as naturalised near St. George.

The authors describe the weed, giving the different popular names: "Cape Spinach", "Spiny Emex", "Goathead Burr", "Three-cornered Jack", "Cats, Heads", "Cape Dubbeltje-Doorn", "Cape Devils' Thorn", etc.

ANDREW SMITH, in his work on the medicinal plants of Cape Colony, notes the therapeutic properties of the leaves of *Emex australis*. The destruction of the plant should, as with all annuals, take place before the formation of seed.

### INJURIOUS INSECTS AND OTHER LOWER ANIMALS.

#### GENERALITIES

205 - *Insects and Other Enemies of Cultivated Plants, Observed in Ireland during 1914 and 1915* (1); — CARPENTER, GEORGE H., in *The Economic Proceedings of the Royal Dublin Society*, Vol. II, No. 12, pp. 221-237, Fig. 1-8, Pl. XIV-XVII. Dublin, 1916.

CULTIVATED CRUCIFERS — Diamond-back Moth (*Plutella maculipennis* Curtis = *cruciferarum* Zell.), very injurious to white turnips and swedes; Turnip Moth (*Agrotis segetum* L.) damaged cabbages and turnips; Cabbage Fly (*Phorbia brassicae* Bouché) attacking radishes.

CORN. — Oat Aphid (*Aphis avenae* Fab.).

(1) See also B. Jan: 1914, No. 86.

(Ed.)

POTATOES. — Potato Aphid (*Rhopalosiphum solani* Theobald); Black-fly grubs (*Bibio* sp.); Rosy Rustic Moth (*Hydroecia micacea* Esp.).

MANGEL. — Carrion Beetle (*Silpha opaca* L.); Brassy Flea-beetle (*Plectroscelis concinna* Marsh), a new pest of the plant.

CELERY. — Green Leaf Beetle (*Phaedon tumidulus* Germ); Carrot Fly (*Psila rosae* Fab.) .

CARROTS. — Carrot Fly (*Psila rosae* Fab.).

FLAX. — Flax Flea-beetle (*Longitarsus parvulus* Payk.).

TOBACCO. — Heart and Dart Moth (*Agrotis segetum* Schiff. and *A. exclamationis* Linn.)

FRUIT TREES. — Shield Bugs (*Tropicoris rufipes* Linn. and *Palomena prasina* Linn.); Plum Aphid (*Aphis pruni* Réaumur); Garden Chafer (*Phyllopertha horticola* Linn.); Clay-coloured Weevil (*Otiorrhynchus picipes* Fab.); Eyed Hawk Moth (*Smerinthus ocellatus* Linn.); Apple Leaf-miner (*Lyonetia clerckella* Linn.); *Bibio* sp., injuring apple trees;.

ORNAMENTAL PLANTS. — Root Mites (*Rhizoglyphus echinopus* Furn. and Rob.); White Springtails (*Isotoma tenella* Linn.); Green Leaf Weevil (*Phyllobius viridiaeris* Laich) on climbing roses; Black Vine Weevil (*Otiorrhynchus sulcatus* Fab.) on ferns; Winter Moth (*Cheimatobia brumata* Linn.) on Rhododendron leaves; Swift Moths (*Hepialus* sp.) on tulip bulbs.

TREES. — Hazel Larch and Leaf Weevils (*Strophosomus coryli* Fab., and *Phyllobius argentatus* Linn.)

206 — The Effect of Hydrocyanic Gas Fumigation on the Eggs of *Aphis pomi* and *A. avenae*, Apple Parasites, in Ontario. — ROSS, W. A., in *The Canadian Entomologist*, Vol. XLVIII, No. 11, p. 367. London, 1916.

The fumigation of young apple trees with hydrocyanic acid gas just before or shortly after the buds commence to swell not only controls the San José scale (*Aonidiella perniciosus* = *Aspidiotus perniciosus*) but it also destroys the eggs of aphids.

In the spring of 1914 out of seven apple trees obtained from a nursery and well stocked with eggs of *Aphis pomi* and *A. avenae*, three were fumigated with hydrocyanic acid gas (1 oz. KCN to 100 cu. ft., 1:1:3 formula) for 45 minutes and the others used as controls. None of the eggs on the fumigated stock hatched, whereas large numbers hatched on the control trees.

The experiment was repeated in the spring of 1916, and the same satisfactory results were obtained — 100 per cent of the aphid eggs were destroyed.

In 1914 and in 1916, the nursery stock was fumigated 8 days and 6 days respectively before the eggs on the control trees commenced to hatch.

207 — On the Injury to Rice called "Hielo", in the Villavicencio Region, Republic of Columbia. — DAWE, M. T., in *Revista Agrícola*, Year II, No. 6, pp. 327-330. Bogota, 1916.

Although it has nothing to do with frost, there is a disease of rice called "hielo" at Villavicencio, in which region it has been known for over ten years. But, in 1916 it became more serious.

MEANS  
OF PREVENTION  
AND CONTROL

INSECTS, ETC.,  
INJURIOUS  
TO VARIOUS  
CROPS



It is primarily characterised by longitudinal streaks appearing on the leaves and which become more and more evident until the attacked parts dry up and tear. Finally, the leaves rot and droop. The attack is not always general. The same phenomenon has also been noted in maize and probably other gramineae are also attacked.

The writer has shown that the injury to rice in the above region is caused by a small insect which sucks the juices of the leaves. Weakly plants grown on unsuitable soil, give way more easily to attack, while climatic changes may render the plants more susceptible.

The growth of rice and maize together, as practised in this region, favours the disease as maize is also attacked by the insect. Insufficient or bad preparation of the soil results in the production of weakly plants, which cannot support the loss caused by the insect. In the region over which these resarches were made, the rice is grown under what is called "dry" culture. It is probable that, in a region like that of Llanos, near to a mountainous district, having abundant water, and soil naturally suitable for irrigation; the growth of aquatic varieties would give better results.

As a means of control of this pest, the Author advises the use of spraying with a petroleum emulsion.

208 - **Sunflower (*Helianthus annuus*) Roots Deformed by a *Heterodera*, at Porto Tolle, Italy.** — See No. 189 of this *Bulletin*.

209 - ***Tortrix oleraceana* n. sp., a Microlepidopteron Injurious to Cabbages in Newfoundland, N. America.** — GIBSON, ARTHUR, in *The Canadian Entomologist*, Vol. XLVIII, No. 11, pp. 373-375, Pl. X. London, 1916.

In July 1915, in some farms near St. Johns' a large number of small tortrix caterpillars were noticed infesting cabbage leaves. In one farm, they completely destroyed the first planting and a large part of the second.

On breeding out the larvae, it was found that it was not the European species *Tortrix wahlbomiana* L. var. *virgaureana* Tr. — although the latter insect has much affinity with that under discussion — and similarly it was not identical with any of those species described for North America. So the Author proposes the name of *T. oleraceana* n. sp., for the insect which he also describes systematically. During 1916, this insect has caused severe injury in Newfoundland; caterpillars sent have proved, on breeding out, to belong to the new species in question.

210 - **The Olive Fly (*Dacus oleae* var. *asiatica* n. var.) and One of its Parasites Recorded for the First Time in India.** — SILVESTRI, F., in *Rendiconti della Reale Accademia dei Lincei, Classe di Scienze fisiche, matematiche e naturali*, Series 5, 1916, 2nd. Half-Year, Vol. XXV, Part II, pp. 424-427, 1 Fig. Rome, 1916.

The Author who, being firmly convinced that the olive fly and its parasites are present in N. W. India, had requested the entomologist Mr. T. B. FLETCHER to obtain information on this subject — was informed by Mr. FLETCHER that he had collected worm-eaten fruits at Cherat belonging probably to *Olea cuspidata*, from which he had obtained adults of *Dacus oleae* and of an *Opus* parasitic on the former.



After examining the material, the Author discusses and describes specimens of *Dacus oleae* from India as simply representing a new variety (var. *asiatica*) of the type form and the parasite as a new species of *Opius* (*O. ponerophagus*). In his collection, the Author also has specimens of *Dacus oleae* from Beyrouth (Syria) obtained from fruits of *Olea europea* which closely resemble those from India in colour.

The new *Opius* is very close to *O. concolor* Szèpl. and *O. dacicida* Silv.

211 - *Notarcha (Nacoleia) octasema*, a Microlepidopteron Injurious to the Banana, in Java. — LEEFMANS, S., in *Mededeelingen van het Laboratorium voor Plantenziekten*, No. 23, 23 pp., 5 Pl. Batavia, 1916.

Everywhere where bananas are grown in Java the writer has noticed that the fruits are infected, the skin becoming scabby. The damage is usually confined to the skin, but the insects sometimes gnaw the fruits so badly that the interior becomes rotted, thus causing a considerable loss of crop. The scabby fruits cannot be exported, for the Australian importers refuse to accept damaged fruits.

The insect causing the damage (*Notarcha* [*Nacoleia*] *octasema* Meyr) is well known in the New Hebrides, Solomon Islands and Queensland. The insect probably lays its eggs on the flower bracts. After four days, the eggs hatch and the larvae, 1.5 mm. long, proceed towards the fruit. The writer has rarely found the chrysalids between the fruits and he thinks that they are usually to be found among fallen leaves or between the base of the leaves and the stem. The larvae are mature in 11 days, and three days later the cocoon is commenced and eight days after, the adult emerges from the cocoon. The insect requires 30 days for its development in a rainy season, while in a dry season 27 days suffice.

They fly by night, remaining concealed during the day.

A braconid, probably belonging to the genus *Apanteles*, has been found to be a parasite of the larvae. These parasites are not numerous and are not of much importance in controlling *Notarcha*.

The writer's attention was drawn to a method for controlling a similar banana pest in the Fiji Islands by a Java exporter. The method consists in powdering the fruits with a one-in-three mixture of pyrethrum and wood-ash. A few tests with other insecticides as well as with the ash gave unsatisfactory results. The best method of applying the mixture of pyrethrum powder and wood ash is to blow the powder on the fruits with a syringe introduced between the bracts as soon as the inflorescence commences to develop and while the bracts still cover the fruits. 3 grammes of pyrethrum are sufficient for the two treatments, which according to the writer costs 12 centimes per inflorescence in Java. The wood ash may be replaced by powdered lime for mixing with the pyrethrum.

212 - *Alcides frenatus*, a Coleopteron Injurious to the Mangotree, in Bengal. — SEN, P. C., in *Agricultural Department, Bengal, Leaflet No. 2* of 1916.

The larvae of *Alcides frenatus* Fst ("mango shoot-borer") cause severe injury to the mango-trees, especially those that are grafted. It bores galleries in the young shoots. Each year from March to December

serious damage is observed in the Dacca Botanic Garden. The insect also occurs in other localities. When new shoots are formed it is advisable to examine them occasionally and if the adult insect is seen, measures should be taken for its destruction. As far as is possible all shoots containing eggs or larvae should be destroyed. If these measures are carried out from the very first, the damage will be notably reduced.

213 - **Scale Insects as Vine Pests and their Relationships with other Cultivated Plants.**

— JABLONOWSKII J., en *Kísérletügyi Közlemények (Communications from the Experimental Stations of Hungary)*, Vol. XIX, No. 2, pp. 169-285, 31 fig. (From the German summary pp. 286-288). Budapest, 1916.

Scale insects in the Hungarian wine-growing zones have hitherto been of the same importance as in other countries. The situation, however, in Hungary, has been worsened by the fact that the new plains vineyards either on loose sand exempt from phylloxera or on clayey soil, are drawing nearer and nearer to the Robinia plantations which are very seriously attacked by the Coccid *Eulecanium corni* (Bché) var. *robiniarum* (Dougl.) March. (or formerly simply *Lecanium robiniarum* Dougl.). Through the agency of these Robinias the Coccid is carried to the vine. The writer remarks in this connection that the vine considered as plant host, has no particular species of Coccid of its own; in other words no species of scale insect exists whose existence is intimately connected with that of the vine. The Coccids of the vine are mostly occasional pests which live on a great many other plants from whence they may spread to the vine. After a general discussion of the data relative to this question and a brief description of the scale insects recorded as parasitic on the vine, the writer considers the following 6 species which have either been introduced or may be introduced into Hungary as pests of the vine.

*Phenacoccus aceris* (Sig.) observed on the vine, but only very rarely, is common and often present in large numbers in Hungary, in the scars of old wounds on maples, wild chestnuts and fruit trees (especially apple). From the agricultural point of view this scale is of no importance.

*Pseudococcus adonidum* (L.) = *Ps. longispinus* Targ. Tozz., is a pest of conservatory and hot-house plants; it may attack hot-house vines but so far has not been found in Hungary as a field pest.

*Pseudococcus citri* (Risso) = *Ps. brevispinus* Targ. Tozz., is an injurious insect both in conservatory and field. This is the famous species known under the names of *Coccus vitis*, *Dactylopius vitis* Nedzelsky; it is the primary cause of the "phthiriasis" familiar in Eastern history) and of the disease of the vine recently described as the "Jaffa disease". This species is indigenous to Hungary but is not an exclusive pest of the vine; it frequents other plants, passing the winter upon them. Experiments show that there is no fear of its injuring the vines.

*Pulvinaria betulae* (L.) often wrongly designated as *Lecanium vitis*, is frequently present, often in large quantities, upon long pruned vine canes which, owing to the presence of old wood, are more seriously endangered than would otherwise be the case. Vine trellises and espaliers, at the



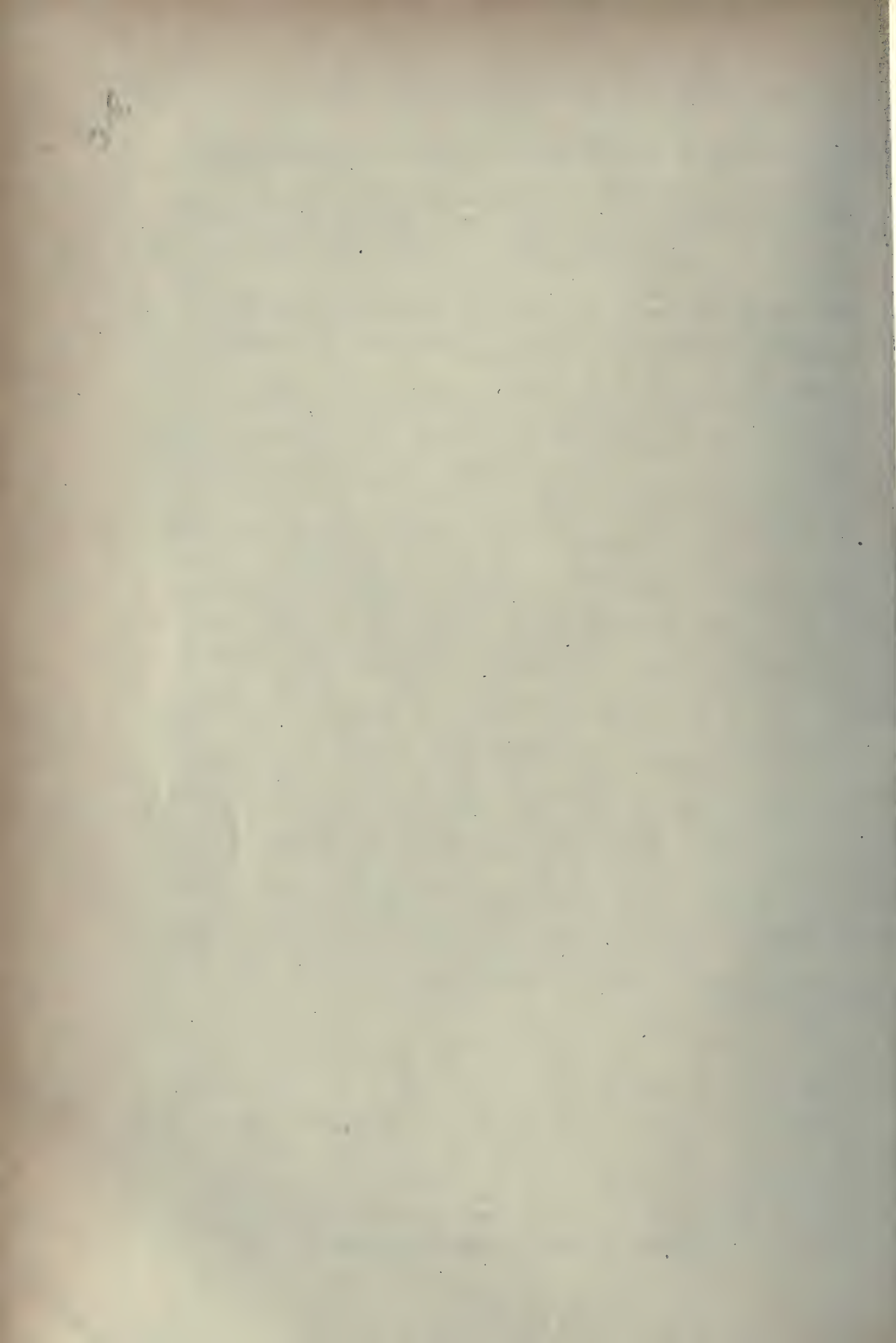
beginning of June, are perfectly white as a result of the presence of this insect.

*Eulecanium corni* (Behé) var. *robiniarum* (Dougl.) March., infests Robinias throughout Hungary and often occurs on isolated trees in masses of surprising size, or in avenues or woods of Robinia whence it easily passes to the vine. During their autumn and spring migrations, the young Coccids may easily be carried by the wind and so reach the vine or other plants. Cases are cited where these scale insects have been able to attain their complete development in potato or hemp fields, on the foliage of sugar beets and on a great number of weeds.

*Eulecanium persicae* often wrongly termed *Lec. vini* Bouché, and which is generally admitted to be a southern representative of the genus, also occurs in Hungary on the vine and in analogous circumstances to the species mentioned above. Long pruning also favours their increase, the more old wood present, the greater the number of scale insects. The two species of coccids just named have the disadvantage of retarding the formation of spring shoots. On the other hand, where spring frosts occur, this may not be without corresponding advantages. The emission of honeydew in large quantities in summer weakens the development of the grapes; "fumago" spoils the quality of the table grape (grapes covered with "fumago" are useless); whilst the crust of "fumago" on the upper surface of the leaves, and the attacks of the young Coccids on the branches, in August and September, hinder the formation of sugar in the grapes.

Short pruning effected annually, results in spring in a great reduction in the number of larvae which have survived the winter. It is thus the best natural means of control. As regards other methods the writer only recommends that of destroying by crushing the big mother scales with their contents immediately after egg-laying. Mere brushing, especially when carried out late, has serious drawbacks. Although the mother and a small portion of the unlaidd eggs may be destroyed, yet the majority of eggs, being on the ground, remain unharmed and may give rise to a number of larvae which will lead to a recurrence of trouble the following year. With regard to spraying on the one hand it is impossible to get at these insects sufficiently well by this method, and, on the other hand, the liquid hitherto employed (carbolineum, strong petroleum emulsions) is not only harmful to the canes, in winter, but often directly fatal.





INTERNATIONAL INSTITUTE OF AGRICULTURE  
BUREAU OF AGRICULTURAL INTELLIGENCE AND PLANT DISEASES

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FIRST PART.

ORIGINAL ARTICLES

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**The Organisation for the Prevention of Fraud in France**

by MAXIME TOUBEAU.

*Principal Divisional Inspector for the Prevention of Fraud.*

Ten years ago a Department for the Prevention of Fraud was instituted in France. When the degree of development this Department has arrived at in ten years is seen, as well as the complexity of the tasks with which it is charged, one has the proof of what can be done in this country, as in others, when it is a question of changing ones former ways and of facing necessities long unheeded.

In 1906, when several States had taken measures against fraud (England, by the law of Aug. 11, 1876; Germany by that of May 14, 1879; Belgium by that of Aug. 4, 1890; Austria by that of Jan 16, 1898), France as yet possessed no State Department for detecting and proving commercial fraud and the adulteration of food stuffs. Offences of this nature were controlled by judicial authority if complaints were laid, according to common law, but without any kind of control similar to that in the above mentioned countries over goods exposed for sale in shops or markets. In certain departments, or rather in a few large towns (particularly at Paris), there were Laboratories and officials who watched over the products so as to assure, according to the municipal law of April 5, 1884, the quality and quantity and to prevent the sale of infected or injurious food stuffs, but excluding these purely departmental or municipal Departments, no comprehensive scheme was available. The Government remained aloof

from these beginnings, while each organisation had its special rules, and in most districts there was no such Department in existence.

The law of August 1, 1905, while repressing fraud more severely than in the past, gave the Government the power to regulate the sale of food stuffs, beverages, medicines, agricultural products, and to found a Department for sampling and analysis so as to control these goods. This law is of prime importance in the history of the new French organization for the repression of fraud. It has enabled France to gain the lost time in a few years, and to take a place – as M. TORTELLI said in 1909 (1) – at the head of the movement directed against an evil which had become, on account of the progress of chemistry, a real economic danger causing much disturbance.

The regulation of July 31, 1906, made in order to apply the law previously cited, is the first text that created in France a method of sampling and analysis and instituted a State service for the detection and proof of fraud, with the cooperation of departments and communes. This regulation is still in force, and if it will be modified on certain points, because of additions made to the 1905 law by later laws, its essential principles seem definitely fixed. These principles are: By virtue of the 1906 regulation, samples may be taken at any time in warehouses, shops, trade vehicles, markets, fairs, market-places, and slaughter-houses in stations or ports of arrival or departure; the law of July 28, 1912, has added to this list, cellars, stables and, in general, all places of manufacture where products liable to inspection are kept in view of sale.

Four samples are taken at a time, sealed and sent to the Prefect of the Department. One sample is sent by the Prefect to the competent Laboratory, under a progressive number, to avoid any collusion between the chemist and the trader. If the result of the analysis is in favour of the dealer, he can claim compensation for the four samples. If the analysis shows intent to fraud, then the papers relating to the affair and the three samples are sent to the Public Prosecutor. This official can quash the process if he thinks that the presumption of fraud has insufficient foundation; on the other hand, he can send it to a court of justice where an expert deals with the subject of litigation: one of the three remaining samples is given to an expert chosen by the examining magistrate, another given to an expert chosen by the accused, the last is saved in case the two experts do not come to a mutual agreement. It is only when the expert for the prosecution has shown that there is fraud or falsification that the presumably guilty person is summoned before a competent court of law in order to be punished according to the law of August 1, 1905.

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(1) Communication to the Italian Chemical Society, Milan Section.



These are the fundamental rules established in France by the decree of July 31, 1906 for the detection of fraud and falsification.

Before any legal intervention, this procedure necessitates the intervention of:

1) persons who take samples of the different objects subject to control (1);

2) Laboratories where the samples are analysed.

As regards the agents, the 1906 decree states that they may be appointed by giving power to police commissaries, special railway and dockyard police, market, fair and slaughter-house inspectors, custom house officers in the execution of their duties, borough or departmental officers approved by the Prefect. As regards the Laboratories, the 1906 decree only states that county and borough laboratories may be approved by the State, to work in cooperation with those of the State in the analysis of samples. No clause decides the organisation of the central Service, upon which the local administration should depend.

The provision of the law of August 1, 1905 and the decree of July 31, 1906 might have long remained a dead letter, as no vote of credit had been passed by Parliament to create this Department for the prevention of fraud. Work thus started with very limited resources. The difficult task was under the care of the Minister for Agriculture, at that time, M. RUAU. He asked M. E. ROUX D. Sc., now Director of the department, to study, under the title of Chief Inspector of Laboratories, the conditions under which the new department could work.

M. ROUX sought out, among the existing laboratories (municipal or county, agricultural stations), those that had such a staff and means which would enable them to analyse specimens of food stuffs and beverages as stated in the 1905 law. The list of these establishments was drawn up, with the conditions of their approval by the State. In addition, the sum allowable for the expense of analysis was calculated at the rate of 5 francs per sample analysed. All that remained to be done was to give the Prefects the necessary credit to cover the cost of sampling, which was

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(1) In fact, these persons should only inspect beverages, food stuffs and agricultural products (seeds, manures, fungus remedies, etc.) in which it is most important to prevent fraud. It is only by exception and on special instructions or on complaint that they intervene for other matters, as the law of Aug. 1, 1906 gives them this power. — As for medical products, they are controlled by a special service: Inspection of Pharmacies (the samples are taken by Inspectors having a pharmacist's diploma and are analysed in Pharmaceutical Schools for that purpose).

first estimated at 2.50 francs per sample, but afterwards raised to 4.35 francs (1).

At the beginning of 1907, the Minister for Agriculture was able to give instructions to the Prefects, inviting each one to organise in his own department the Service for the prevention of fraud and to appoint officers for that purpose from amongst those competent, by virtue of the decree of July 31, 1906, to take samples. The share of samples to be taken was fixed at 1 per 1000 inhabitants, and as the cost of each sampling was then fixed at 7.50 fr. (5 for analysis, 2.50 for the rest), the credit allowed was based on this figure multiplied by the number of samples to be taken in each department, given the number of population. After January 18, 1907, the analytical methods to be used in the Laboratories for the analysis of food stuffs were published in the Official Journal; on February 18, 1907, 18 municipal or departmental Laboratories were accepted; finally, by the decree of April 24, 1907, the Central Service for the prevention of fraud, with M. ROUX as director, was officially recognised by the Ministry of Agriculture.

During the first working year 30720 samples of food or agricultural products were taken over all the territory by the 931 officials chosen by the Prefects (chiefly police commissaries); the proportion of samples pronounced suspect was 19.8 per cent.; numerous condemnations were obtained. The fraudulent knew that there was a control of goods in France and that they could no longer profit from the dislike of their victims for costly law suits to carry out their shameless and profitable speculations.

After the publication of the first results, Parliament showed great interest in the new Service, and voted the credits requisite to assure its development and to increase the number of samples taken. A decree of October 21, 1907 instituted, as a consequence, a body of 15 Inspectors under the Director of the service for the detection of fraud who were charged with technical inquiries and acted as a link between the Central Administration and the prefectural Services for this purpose. Another decree of January 17, 1908 created a Central Laboratory for the prevention of fraud situated at Paris, with a staff of a Director, two chief chemists, ten

(1) The 4.35 francs are made up as follows:

Award to the officer . . . . .	1.00 francs
Compensation for the samples . . . . .	1.25 "
Other expenses, . . . . .	0.50 "
Travelling expenses, . . . . .	1.60 "

Total 4.35 francs

On adding the cost of analysis (say 5 fr.) we get the total of 9.35 fr., the cost estimated for each sample taken.

chemists, and four secretaries. This Laboratory has to carry out scientific researches in relation to the prevention of fraud, to give advice to the regional Laboratories in case they desire it, and to analyse part of the samples taken in the Parisian region, the other part being analysed by the Paris City Laboratory which was accepted for that purpose.

In consequence, this Department has increased both by the number of coopted Laboratories and by the number of its officials; on August 1, 1914, when war was declared, it included:

1) *Inspectors and officials for sampling:*

- 1 Chief Inspector
  - 3 Chief divisional Inspectors
  - 11 Divisional Inspectors
- } (decree of Oct. 21, 1907).
- 50 Departmental Inspectors (decree of Oct. 12, 1913).
  - 82 Syndical agents (recognised by the Minister of Agriculture, according to article 65 of the Finance law of Feb. 27, 1907).
  - 1000 local officials (variable number) chosen by the Prefect in each Department according to the decree of July 31, 1906 and particularly chosen from police commissaries; these officials receive the instructions of the Minister of Agriculture by the Prefects as intermediaries, while the Inspectors for the prevention of fraud are directly under the control of the Director of the Department.

2) *Laboratories that analyse the samples:*

Central Laboratory of the Ministry of Agriculture.

- 2 Laboratories of the Ministry of Finance.
- 1 Laboratory for the War Ministry (for the analysis of preserved foods).
- 1 Agricultural and horticultural Station.
- 3 Oenological Stations.
- 1 Seed testing Station.
- 1 Laboratory for the analysis of resinous products.
- 1 Research Laboratory, also for the control of hygienic and medical products.
- 20 Municipal Laboratories.
- 4 Departmental Laboratories.
- 23 Agricultural Stations.

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Total 57 Establishments.

Amongst these Laboratories, only one has been founded: the Central Laboratory of the Ministry of Agriculture; the others were already in existence; they have been grouped and utilised for the prevention of fraud, which itself is now included in a much bigger department, that of the "Services Sanitaires et Scientifiques et de la Répression des fraudes", under the direction of M. E. ROUX. The Laboratories have a regional standing as they only analyse samples taken in their own particular region; but some special Laboratories are available for the whole of France. Thus, samples of preserved foods are sent, no matter where they come from, to



the Laboratory for preserved foods of the War Ministry. Similarly, seed samples are sent to the seed-testing Station at Paris, and resinous products to the Laboratory for the analysis of resinous products at Bordeaux.

Each year the Minister of Agriculture divides out the credits necessary for the working of the sampling and analytical services. In 1913, sampling cost 242 403 fr. and analysis 206 935 fr.; in 1914 the estimated cost of sampling was 280 000 fr. and that of analysis 364 090 fr.; but because of the war they were reduced for economy to 180 000 and 290 000 francs.

The total credit for the Service for the detection of fraud is not high: in 1908 it was 909 500 fr., in 1909, 940 000 fr., in 1910, 1 090 000 fr., and 1913, 1 174 500 fr.

It is due to these expenses, relatively small for a large State, that the operations could be carried out that are summarised in the following table, taken from the report by the Deputy, M. DARIAC, on the budget for the Minister of Agriculture for 1914:

*General Statistics of Sampling in France from 1907 to 1912.*

Nature of the products sampled	Samples taken in 1907		Samples taken in 1908		Samples taken in 1909		Samples taken in 1910		Samples taken in 1911		Samples taken in 1912	
	Number	% of doubtful	Number	% of doubtful	Number	% of doubtful	Number	% of doubtful	Number	% of doubtful	Number	% of doubtful
Milk . . . . .	8,106	35.4	17,504	21.5	22,434	21.2	22,801	20.2	25,851	21.5	25,659	17.6
Wine . . . . .	5,795	17.0	10,911	17.7	12,487	17.1	15,994	19.8	17,694	23.6	18,730	24.7
Vinegar . . . . .	492	25.6	849	15.2	753	11.9	672	10.4	722	12.6	643	12.4
Cider . . . . .	406	16.9	794	27.2	905	13.0	1,131	15.2	1,364	16.7	961	6.0
Beer . . . . .	347	21.9	726	3.0	975	1.5	945	2.2	1,038	0.8	746	1.7
Spirits . . . . .	593	16.3	2,015	16.5	1,884	19.7	1,728	14.5	1,969	18.8	2,452	29.7
Butter . . . . .	1,497	13.9	2,882	12.9	2,180	11.4	2,459	12.9	2,707	15.3	2,538	11.4
Oils . . . . .	1,884	41.0	3,872	19.0	3,822	11.3	3,101	8.9	2,934	7.0	2,865	7.3
Seeds, cakes . . . .	—	—	1,991	12.2	2,030	7.8	1,764	9.2	1,743	8.3	1,520	6.4
Other products . . .	11,600	8.0	26,182	7.6	24,574	6.7	24,843	5.3	24,396	4.5	24,344	5.1
<i>Totals and averages</i>	30,720	19.7	67,726	14.4	72,044	13.8	75,438	13.7	80,688	15.4	80,458	14.7

Resulting from the sampling, many persons have been found guilty by the courts of law: 1188 in 1907; between four and five thousand in each of the following years. The total of the fines paid into the treasury has become higher than the credit allotted to the Service; in 1911 it reached 1 283 461 fr.; 1 483 671 fr. in 1912. In 1910, due to the discovery of considerable fiscal frauds together with a case of commercial fraud (watering wine) the total of the fines reached 4 709 053 francs. These figures show that

the Service for the detection of fraud, as it is in France, is one of these rare administrative Services that, instead of being a charge on the State, actually are remunerative.

Since the beginning of war, the Service has been very useful. The staff was much reduced by mobilisation and the number of samples taken has been reduced; some Laboratories have been closed, but the control of products and the search for defrauders has been continued vigorously: in 1914 the 50,000 samples taken lead to 3000 convictions; in 1915, the 35,589 samples led to 3137 convictions; and in the first half-year of 1916, there were 22,744 samples and about 2000 convictions (figures that show no sensible increase of crime).

Since the war, the work the Service has been chiefly centred on food stuffs of prime necessity and on the numerous products for the use of prisoners or soldiers; juices or extracts of meat, invalid foods, loaves or biscuits, water sterilisers, various hygienic products. The high price of certain foods has lead to the production of many substitutes which have also been examined by the Service; products for producing cheap beverages, to replace the chicory grown in that part of the North of France occupied by the enemy. The officers of the Service have also applied new laws: that of March 12, 1915 on the prohibition of absinthe and such like drinks, that of April 25, 1916 on the revictualling of the civil population with wheat and flour (only whole meal flour allowed to be made); they also have to see the carrying out of the decrees fixing taxes or the prices of various products in the towns interested. Their vigilance is particularly exercised in the war zone, as the Minister of Agriculture states in a report to the President of the Republic inserted in the Official Gazette of April 1, 1916.

Since its foundation, the Service for the detection of fraud in France has continued to extend its scope; it has made possible the creation and application of a new law (1); it has accustomed commerce to a necessary control; the results of its intervention have been recognised as excellent; fraud, that was increasing so rapidly, has been made difficult; the proportion of samples found fraudulent by the Laboratories has decreased from

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(1) The law of Aug. 1, 1905 on the prevention of fraud in the commerce of any goods was completed by the laws of Aug. 5, 1908 and July 28, 1912, as well as by a series of regulations for public administration that has defined certain products (wines and spirits, beers, ciders, vinegars, syrups and liqueurs, meads, fats and oils, confectionary and chocolate, preserves of meat or legumes) or defined the limits of certain regions (wine-producing regions of Champagne, Banyuls, Bordeaux, Brandies of Cognac, Armagnac). The officers of the Service are of course responsible for the application of these regulations.

19.7 per cent. in 1907, to 14.4 per cent. after the second working year of the Service, and was 14.7 per cent. in 1912, because the samples were taken by more expert officers from products judged from good knowledge to be abnormal at the time of sampling. Finally, since the war, the Service has constituted a safeguard against the enterprises of unscrupulous traders, with the aid of the honest traders that form the immense majority and who have shown, like all other classes in France, the purest patriotism during the present great crisis.

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## SECOND PART.

# ABSTRACTS

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## AGRICULTURAL INTELLIGENCE

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### GENERAL INFORMATION.

214 - Appropriations of the Federal Department of Agriculture of the United States for the Fiscal Year Ending June 30, 1917, in *Experiment Station Record*, Vol. 35, No. 4, pp. 301-310, Washington, September 1916..

The appropriations carried in the last act covering the fiscal year ending June 30, 1917 aggregate \$ 26 948 852.

This is an increase of \$ 2 349 763 over the estimates submitted by the Department and an increase of \$ 3 977 070 over the amount carried in the act for the previous year.

Out of the allotments to the various Bureaus of the Federal Department of Agriculture, the Weather Bureau receives \$ 1 747 26c.

The appropriations directly allotted to the Bureau of Animal Industry aggregate \$ 3 020 746, but this is supplemented by extensive funds provided elsewhere.

The inspection and quarantine work of the Bureau against animal diseases receives \$ 532 780, a decrease of \$ 75 000 due to the reduced area under quarantine for sheep and cattle scabies. For pathological studies of animal diseases \$ 138 020 is granted, of which \$ 50 000 is a new item authorizing work on contagious abortion. For the tick-eradication campaign an appropriation of \$ 632 400 is given, and it is expected that this will be supplemented by State and county funds sufficient to make a total of nearly \$ 1 000 000.

The act carries \$ 360 000 to continue the hog-cholera work, of which \$ 175 000 may be used for the enforcement of the virus-serum-toxin act, and \$ 35 000 for research. An allotment of \$ 75 000 is also made for the investigation, treatment, and eradication of dourine.

The eradication of foot-and-mouth disease is followed by a reduction in the emergency appropriation for this and similar diseases, from \$ 2 500 000 to \$ 1 250 000, plus the

LEGISLATIVE  
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MEASURES.

unexpended balance of \$ 655 790 93 from the previous year. The meat-inspection work is continued much as at present, a permanent appropriation of \$ 3 000 000 per annum being augmented by a supplementary allotment of \$ 344 500.

A net increase of \$ 27 620 is provided for the encouragement of dairying and one of \$ 19 260 for that of animal husbandry, making \$ 277 470 and \$ 208 320, respectively, available for these purposes. It is planned to extend especially the studies in dairy farming, dairy research, the milk and cheese investigations and demonstrations, and the studies of pork production, Shorthorn cattle breeding, poultry breeding, range sheep breeding and management, and the classification of wools.

A special appropriation of \$ .60 000 is continued for the work in live-stock production in the cane-sugar and cotton districts, now being conducted in close cooperation with the State of Louisiana. This State has deeded to the Department a farm of about 500 acres at New Iberia, and this farm has been divided into four tracts for work with horses and mules, beef cattle, dairy cattle and hogs, and hogs alone. A large number of demonstrations and other extension work in animal production and dairying are also under way. Somewhat similar work is contemplated under a new appropriation of \$ 40 000 for experiments in dairying and live-stock production in semiarid and irrigated districts of the Western States.

The Bureau of Plant Industry receives an increase from \$ 2 139 150 to \$ 2 537 120, its appropriation being divided as usual among a large number of projects. Among the most important new items is that allotting \$ 250 000 for continuing the campaign against the highly infectious disease known as citrus canker. Another large increase is that of \$ 30 000 for studies of white-june blister rust and other epidemic tree diseases.

Other extensions of work provided for include \$ 6 500 for studies of tobacco diseases, \$ 5 000 for citrus and subtropical fruit diseases and a like amount for breeding disease-resistant citrus varieties, \$ 2 500 for carrying on soil studies in connection with the powdery scab of potato, \$ 5 000 for extension work in cotton growing and \$ 3 000 for cotton diseases, \$ 5 000 for the development of work on plant-infesting nematodes, \$ 8 350 for establishing a new grain standardization laboratory in Minnesota, \$ 7 500 for studies on the handling, grading, and transportation of the grain sorghums, \$ 7 500 for studies of the water requirements of crops in the irrigated regions, \$ 22 500 for investigations of black rust and stripe rust of wheat, oats, and barley, and other cereal diseases, \$ 10 000 for the development of an American sugar-beet seed industry, and \$ 21 000 to extend and develop the forage-crop investigations and provide for the more effective distribution of new and rare varieties of seeds.

The congressional seed distribution is continued on the usual basis with an allotment of \$ 252 540.

The allotments for the Forest Service, as usual, far exceed those for any other bureau. The aggregate is \$ 8 549 735 but \$ 3 000 000 of this sum is for additional purchases under the Appalachian Forest Reserve Act, \$ 2 000 000 of which is not available until July 1, 1917. An appropriation of \$ 100 000 is also continued for cooperation in the States in fire protection work under the same act.

The appropriation for the Bureau of Chemistry aggregates \$ 1 153 801 of which over half is for the enforcement of the Food and Drugs Act. The purchase and equipment of a travelling laboratory at a cost of \$ 7 500 is authorized.

The various lines of work under way are continued without change and \$ 50 000 is added for studies of the utilization for colouring purposes of raw domestic materials, more particularly with reference to their use in food products. The studies of naval stores were

also definitely assigned to the Bureau of Chemistry and \$ 5 000 additional was granted to carry ou demonstrations of improved methods for preparing these commodities.

The Bureau of Soils is granted \$ 175 000 for experiments and demonstrations to determine the best methods of obtaining potash on a commercial scale. The remaining lines of work of the Bureau are continued unchanged, the total appropriation being \$ 503 735.

An increase of \$ 38 980 is accorded the Bureau of Entomology. This is divided among a number of projects, including extension work in bee culture, and studies of the grape-berry moth, clover seed midge, clover root borer, tobacco hornworm, insects instrumental in the carriage of cucumber diseases and biting flies and other insects affecting the health of domestic animals. The gipsy and brown-tail moth campaign is allotted \$ 305 050 and the Bureau as a whole \$ 868 880.

The Bureau of Biological Survey is granted \$ 578 230. The principal change is an increase of \$ 125 000 to be used on the public lands, National Forests, and elsewhere in the Western and Northwestern States to combat the spread of rabies by destroying wolves, coyotes, and other predatory wild animals.

This appropriation followed a serious outbreak of the disease in these States, in which serious losses to live stock and even human cases of the disease resulted from an epidemic among coyotes, and continues work begun earlier in the year under a deficiency appropriation of \$ 75 000.

The total appropriation for the States Relations Service is \$ 2 969 680, as compared with \$ 2 821 840 for the previous year. The main item of increase is one of \$ 100 000 for the farmers, cooperative demonstration work outside the cotton belt. This will permit of considerable further extension of that work and of initiating in a small way extension work by women county agents. There is also an increase of \$ 23 000 for the experiment stations in Alaska, Hawaii and Porto Rico. The other lines of work, including the maintenance of the State experiment stations, the farmers' cooperative demonstration work in the cotton belt, the study of famers' institutes and agricultural schools, and the investigation in home economics are continued on the existing basis.

The funds allotted to the Office of Markets and Rural Organization are nearly doubled, the total of \$ 872 590 allowing for a considerable expansion in its work. During the crop season of 1915 an experimental new service was conducted giving timely information on the movements and prices of the strawberry, tomato, cantaloup, and peach crops, with such successful results that \$ 136 600 is now provided for systematic service in the collection and distribution of market news by telegraph for perishable fruits and vegetables and by mail for oter farm products.

Other new items are \$ 65 000 for the gathering of information pertaining to the marketing of live stock and its products and \$ 35 000 for cooperation with the States in marketing studies. An increase from \$ 238 000 to \$ 285 000 is granted for other marketing and distribution studies, notably for additional attention to cooperative purchasing and marketing, market grades and standards, marketing business practice, and the marketing of live stock, meats, animal by-products, dairy products, grain, seeds and hay. The Office also receives \$ 48 000 to continue the cotton-standardization work and \$ 32 860 for its studies in rural organization.

An increase from \$ 50 000 to \$ 75 000 is provided for the enforcement of the plant-quarantine act by the Federal Horticultural Board. Of this sum \$ 15 000 is to be used to prevent the introduction of the pink bollworm, one of the most serious cotton pests



known, and \$ 10 000 for the inspection of the imported potatoes to guard against potato-wart and other diseases and insect pests.

The work of the remaining branches of the Department is continued on substantially the present basis, both as to funds and lines of work.

The Bureau of Crop Estimates receives \$ 316 436, an increase of \$ 32 956, mainly for the employment of additional field agents and specialists, notably in truck and fruit crops. The Office of Public Roads and Rural Engineering is granted \$ 599 200, an increase of \$ 12 735; the Office of the Secretary \$ 688 160, of which \$ 285 810 is for the Office of Farm Management; the Division of Accounts and Disbursements \$ 44 920; the Division of Publications \$ 197 650; and the Library \$ 49 520.

The Department is again allotted \$ 105 000 for the enforcement of the insecticide act, \$ 40 000 to continue demonstration work on reclamation projects, and \$ 123 689 for rent of buildings in the District of Columbia, and receives \$ 122 500 for miscellaneous expenses.

The three noteworthy measures appended to the main portion of the act, designated respectively as the United States Cotton-Futures Act, the United States Grain Standards Act and the United States Warehouse Act are designed to alleviate some of the difficulties which have frequently confronted farmers in the marketing of the staple agricultural crops. The United States Cotton Futures Act as reenacted, follows substantially the text of the act passed in 1914. That measure was a taxing statute designed to regulate future trading in cotton; it imposed a tax at the rate of two cents per pound on all contracts of sale of cotton for future delivery entered into on exchanges and like institutions, unless such contracts complied with certain conditions which were calculated to eliminate certain recognized evils in future dealings.

The United States Grain-Standards Act authorizes the Secretary of Agriculture to investigate the handling and grading of grain, establish official standards, license grain inspectors and otherwise administer its provisions.

The central purpose of the United States Warehouse Act is to establish a form of warehouse receipt for cotton, grain, wool, tobacco, and flaxseed which will make these receipts easily and widely negotiable as delivery orders or a collateral for loans, and therefore of definite assistance in financing crops.

The funds administered by the Department of Agriculture but appropriated in other ways aggregate \$ 10 604 000, the largest items being those of \$ 5 000 000 for the construction of rural post roads, \$ 3 000 000 for meat inspection, \$ 1 580 000 under the Smith-Lever Extension Act, the remainder being chiefly for payments to the States as their quota of the receipts from the National Forests. There is also the appropriation for the Department printing and binding, carried as usual in the appropriation act for sundry civil expenses. This appropriation has been increased from \$ 500 000 to \$ 600 000, of which \$ 47 000 is for the Weather Bureau and \$ 177 500 as increase of \$ 40 000 for use in the publication of Farmers' Bulletins.

The federal appropriations for agricultural purposes are not confined to the Department of Agriculture. The usual large appropriations will be available for agricultural education in the land grant colleges under the Morris and Nelson Acts, as well as the smaller grants for the rural education work at the Bureau of Education, demonstration, work among the Indians and the payment of the country's quota toward the support of the International Institute of Agriculture.

Besides the aid granted under the Federal Farm Loan Act, a provision is also carried in the National Defence Act of June 3, 1916, for an investigation of means for the production of nitrates and other products for munitions of war and useful in the manufacture of fertilizers, and for the construction and operation by the Government of a plant or plants to manufacture these products. This enterprise carries an appropriation of \$ 20 000 000.

The substantial aid tendered to agriculture in these various ways indicates anew the increasing popular realization of the responsibility of the Federal Government in the development of the Nation's basic industry.

#### 215 — The Distribution of Crops and Farm Animals in the United States. —

FLOWER, P. W. in *The Field*, Vol. XXVI, No. 12, p. 1031, New York, December 1916.

The following table gives the acreage devoted to the chief crops in the different States of the Union and the distribution of cattle, horses, mules, swine and sheep. It was compiled by the writer, at the request of the Taylor-Critchfield-Clayne Company from the official statistics of the United States Department of Agriculture. The table shows how the various States compare as to crops and live-stock.

Thus, while New York is 1<sup>st</sup> in hay and in number of dairy cows, it is 25<sup>th</sup> in wheat, 26<sup>th</sup> in maize and 27<sup>th</sup> in number of swine.

On the other hand, Texas is first in cotton, 2<sup>nd</sup> in rice, 3<sup>rd</sup> in maize etc., but 1<sup>st</sup> in number of beef cattle and mules, and 3<sup>rd</sup> in horse-breeding.

In this table, the letters (*a*), (*b*), (*c*), (*d*) are used in the order of their importance when the crop acreage, or the number of stock, are approximately equal. Thus the States of Missouri and Nebraska are tied for the 4<sup>th</sup> place in maize, but the acreage under this crop is a little larger in the former than in the latter State. This is expressed by the symbols 4 (*a*) and 4 (*b*).

DEVELOPMENT  
OF  
AGRICULTURE  
IN DIFFERENT  
COUNTRIES

## How Crops and Farm Animals are Distributed in the United States.

Districts and States	Crops								Farm Animals							
	Maize	Wheat	Hay	Oats	Rye	Barley	Flax	Buck-wheat	Cotton	Tobacco	Rice	Dairy cows	Other cows	Horses	Swine	Sheep
New England:																
Maine . . . . .	42	37	14	32	—	23 (a)	—	8	—	—	—	33	40	36	39	35
New Hampshire . . . . .	39 (a)	—	26	41	—	24	—	17 (c)	—	22 (a)	—	40	43	43	44	41
Vermont . . . . .	35	38	15 (a)	35	29 (c)	19 (b)	—	11	—	22 (b)	—	25	33	38	37	39
Massachusetts . . . . .	34	—	27	42 (b)	27 (a)	—	—	16	—	13	—	34	41	41	38 (a)	44
Rhode Island . . . . .	43	—	44	45	—	—	—	—	—	—	—	46	44	46	46	47
Connecticut . . . . .	32	—	33	40 (b)	24	—	—	15 (a)	—	9	—	38	42	44	43	45
Middle Atlantic:																
New York . . . . .	26	25	1	14	7 (a)	12 (b)	—	1	—	14	—	1	14	15	27	20
New Jersey . . . . .	28	34	35	36	10	—	—	10 (a)	—	—	—	35	45	37	36	43
Pennsylvania . . . . .	22	13	2	13	4	12 (d)	—	2	—	8	—	7	23	16	22	19
East North Central:																
Ohio . . . . .	11	11	5	8	8	17	—	7	—	4	—	8	16	7	6	5
Indiana . . . . .	6	8	10	10	7 (b)	21 (a)	—	13	—	11	—	12	20	9	5	17
Illinois . . . . .	1	7	9	2	14	14	—	14	—	18	—	6	8	2	2	18
Michigan . . . . .	21	16	8	11	2	12 (a)	—	3	—	—	—	9	19	14	20	10
Wisconsin . . . . .	20	30	6	6	1	5	7 (a)	6	—	7	—	2	7	13	10	23
West North Central:																
Minnesota . . . . .	16 (a)	3	13	3	3	3	2	12 (a)	—	—	—	4	9	8	12	27
Iowa . . . . .	2	18	3	1	12	6	6	12 (b)	—	—	—	3	2	1	1	15
Missouri . . . . .	4 (a)	9	4	16	16	23 (c)	8	15 (e)	12	16	10 (b)	10	6	5	3	14
North Dakota . . . . .	25	2	28	4	6	1	1	—	—	—	—	21	24	10	28	30
South Dakota . . . . .	14	5	24	7	9	4	4	—	—	—	—	16	13	11	21	25
Nebraska . . . . .	4 (a)	4	12	5	5	11	7 (b)	17 (b)	—	—	—	13	3	6	4	28



Delaware . . . . .	29	31 (b)	43	43	23 (a)	—	—	15 (b)	—	—	—	—	—	—	44	40	45	42	46	31 (a)
Maryland . . . . .	24	32	39	—	16 (b)	23 (d)	—	9	—	—	—	—	—	—	32	40	31	31	31	23
District of Columbia . . . . .	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Virginia . . . . .	19	15	22	29	11	—	—	5	13	3	—	—	—	—	23	32 (a)	20 (b)	23	22	18
West Virginia . . . . .	23 (b)	27	21	33 (b)	19	—	—	4	—	12	—	—	—	—	28	37	28	30	21	27
North Carolina . . . . .	15	17	34	24	13 (a)	19 (c)	—	10 (b)	8	—	10 (a)	—	—	—	24	36	30	14	34	11
South Carolina . . . . .	18	32	40	19	27 (d)	—	—	—	5	6	—	—	—	5	31	39	39	26	42	12
Georgia . . . . .	7	26	37	17	20 (b)	—	—	—	2	17	—	—	—	7	—	22	35	9	36	3
Florida . . . . .	23 (a)	—	45	37	—	—	—	—	11	15	—	—	—	8	37 (d)	18	42	24	38 (a)	21
<i>East South Central:</i>																				
Kentucky . . . . .	10	20 (b)	17	31	16 (a)	22 (d)	—	—	—	1	—	—	—	—	18	25	18	13	16	10
Tennessee . . . . .	13	19	16	21	18	22 (b)	—	15 (d)	10	5	—	—	—	—	22	30	21	18	24	7
Alabama . . . . .	9	33	38 (a)	18 (a)	26	—	—	—	3	21 (b)	9	—	—	9	20	28	32	11	38 (b)	5
Mississippi . . . . .	12	—	38 (c)	27	—	—	—	—	4	—	6	—	—	6	17	27	26	15	32	4
<i>West South Central:</i>																				
Arkansas . . . . .	16 (b)	29	36	20	29 (a)	—	—	—	6	19	3	—	—	3	19	29	24	16	37	9
Louisiana . . . . .	17	—	38 (b)	33 (a)	—	—	—	—	9	20	1	—	—	1	27	31	29	17	31	14
Oklahoma . . . . .	8	6	30	12	25	21 (c)	—	—	7	—	—	—	—	—	15	10	12	19	40	6
Texas . . . . .	3	12	29	15	28	20	—	—	1	21 (a)	2	—	—	2	5	1	3	7	8	1
<i>Mountain:</i>																				
Montana . . . . .	31	14	20	18 (b)	21	13	3	—	—	—	—	—	—	—	36	15	19	34	2	—
Idaho . . . . .	39 (b)	21	23	22	27 (c)	8	—	—	—	—	—	—	—	—	37 (a)	35	25	32	4	32 (a)
Wyoming . . . . .	38	31 (a)	25	28	22	18	9	—	—	—	—	—	—	—	43	21	31	41	1	34 (a)
Colorado . . . . .	27	23	15 (b)	25	15	10 (a)	10	—	—	—	—	—	—	—	29	11	20 (a)	33	12	24
New Mexico . . . . .	30	35	41	38	—	21 (b)	—	—	—	—	—	—	—	—	41	12	27	40	3	25
Arizona . . . . .	40	36	42	42 (a)	—	16	—	—	—	—	—	—	—	—	42	17	34	45 (b)	11	30
Utah . . . . .	41	28	31	34	20 (a)	15	—	—	—	—	—	—	—	—	39	34	33	38 (b)	9	34 (b)
Nevada . . . . .	44	35	39	40 (a)	—	19 (a)	—	—	—	—	—	—	—	—	45	32 (b)	40	45 (d)	13	33 (b)
<i>Pacific:</i>																				
Washington . . . . .	36	10	19	26	23 (a)	9	—	—	—	—	—	—	—	—	26	38	22	35	26	26 (b)
Oregon . . . . .	37	20 (a)	18	23	17	10 (b)	—	—	—	—	—	—	—	—	30	26	23	29	6	28
California . . . . .	33	24	7	30	23 (b)	2	—	—	14	—	4	—	—	—	14	5	17	25	7	17
<i>All other States . . . . .</i>																				

*Pacific:*

All other States

216 — **Pigs and the Spread of the Ectoparasites of Man in Tropical Regions.** — ROUBAUD, E., in *Bulletin de la Société de Pathologie Exotique*, Vol. IX, No. 10, pp. 768-771, Paris, 1916:

In the course of researches on *Auchmeromyia* (*Bulletin Scientifique de la Société de France et de Belgique*, Vol. XLVII, 2, June 24, 1913; *Etudes sur la faune parasitaire de l'Afrique occidentale française*, I, Paris, Larose, 1914) the writer has shown the relationship existing, from the point of view of the blood sucking *Calliphora* larvae, between man and certain types of bare-skinned mammals living in holes, such as the genera *Phacochaerus* (pigs common in tropical Africa) and *Orycteropus* (Edentates). The writer has shown that the *Cheromyia* of the burrows of *Phacochaerus*, whose blood it sucks, is closely related to the *Auchmeromyia* of man; these two larvae can be experimentally reared on both pig and man. In addition, the Author has shown with BOUET (*Bulletin de la Société de Pathologie exotique*, Vol. IX, No. 4, April 12, 1916) that *Cheromyia* is also found in houses, apparently for ovipositing there. These investigations have shown the close relationship that exists, as regards the nutrition of ectoparasites, between man and bare-skinned mammals, particularly pigs. The writer gives other instances, all tending to show the importance of this idea, which up to now was purely theoretical.

In the burrows of *Phacochaerus* in Rhodesia, LLOYD has found the tick of man, *Ornithodoros moubata* (which transmits African tick fever) in a region far from any village and where the tick was not known by the natives. WELLMANN has seen the tick in pig-styes in Angola, and R. VAN SAGEGHEM has observed a similar fact in the Zambi district (Belgian Lower Congo). Again, in Mexico, an *Argas*, *O. turicata* attacks both man and pig.

The Jigger flea (*Sarcopsylla penetrans*) of man bears the characteristic name of *bicho de porco* in certain regions of Brazil. VAN SAGEGHEM has found it on the pig at Zambi, and BLANCHARD has found it on the pig in Liberia.

The Portuguese Mission for the study of sleeping sickness in Prince's Island (Gulf of Guinea) has shown in its final Report (*Arquivos de Higiene e Pathologia exoticas*, Vol. V, March 30, 1915) the close association existing in the Island between the pigs and the tsetse fly (*Glossina palpalis*). The fly attacked in large numbers the herds of half-wild pigs originated from the domestic races introduced into the island; the systematic destruction of the wild pigs, together with direct measures for destroying the tsetse flies, has soon brought about its disappearance. Moreover, MOISER (*Bulletin of Entomological Research*, 1913) has proved that *Phacochaerus* is abundant in places where *Glossina tachinoides* breeds.

It thus seems justifiable to think that many other habitual or occasional ectoparasites of man can use wild or domesticated pigs as supplementary

or preferential hosts, or inversely. The *Sarcoptes* causing mange in the pig is easily transmitted to man, though no other host is known. That of the goat passes equally to man or to the pig. In his researches on exanthematic typhus, NÖLLER (*Berliner Klinische Wochenschrift*, July 10, 1916) has found that the pig louse can live for a long time on man, and that inversely the human clothes louse (*Pediculus vestimenti*) can live on the pig for more than seven days.

According to this mass of converging evidence, pigs are nearest to man as regards the possibility of nourishing ectoparasites. Thus there is no doubt that these ectoparasites, common to both pig and man, are the possible agents for transmitting serious tropical diseases. This is known to be a fact for certain pathogenic trypanosomes (*Trypanosoma dimorphon*, *Tr. pecandi*, *Tr. rhodiense* in particular), so researches should be elaborated on these lines.

217 — **The First 37 Years of the Royal Hungarian School for "Maitres d'eau" at Kassa (1879-1916).** — ROHRINGER, S., in *Vízügyi Közlemények* (*Bulletin of Hydraulics*), Year VI, Part 5, pp. 148-158, 6 illustrations. Budapest, September-October 1916.

AGRICULTURAL  
EDUCATION.

*History of the School.* — At the time when the engineering institute for agricultural hydraulics commenced to work in Hungary, it was urgently required to form an auxiliary staff having the special knowledge required for carrying out hydraulic work. In 1879, on the initiative of Baron GABRIEL DE KERMÉNY, Minister of Agriculture, the creation of the first course for "maitres d'eau" was inaugurated on December 1, of the same year with 9 students in the building of the Kassa Agricultural Institute under the direction of the head of that Institute.

Three winter sessions, each of four months made up the course; while 3 Professors of the Institute and 2 hydraulic agricultural engineers were charged with the teaching. The first students were mostly former non-commissioned officers from a military engineering corps, that is, adults capable of being employed practically after the winter course.

In 1884, on ground belonging to the agricultural Institute, a special building was erected where the Bureau of Agricultural Hydraulics, formerly in charge of the School, was installed, and the teaching then largely fell to the engineers of this Bureau. The general tendency of soil improvement work makes it probable that the recruiting of a sufficient number of "maitres d'eau" will require the permanent upkeep of the School. In 1887, the first regulation was suspended and parallel classes were started to train a sufficient number of students so as to provide for the works undertaken by the bureaux. This regulation was modified in 1890, because, the water service having been centred at the Ministry of Agriculture, it became also necessary to appoint River Boards officers and to improve the



instruction of the guardians of dams and embankments in the service of the Water Companies. Therefore the Minister of Agriculture allowed such persons to be admitted to the School, as long as the buildings had space enough.

The increase of the staff of the Bureau, of the collections and tools of the School and Bureau made it necessary to erect (in 1908) a new building, sufficiently large to accommodate 60 to 75 students. This building it cost 265,217 *Kronen* (1) and the teaching material is valued at 30,000 *Kronen*, which increases every year because of the continual acquisition of books, instruments, etc.

Up to the present, the School has had a total of 481 students, of which 97 were admitted in 1879-1889, 162 in 1889-1899, 113 in 1899-1909, and 109 in 1909 to 1914. Out of the 481 students 383 (79 %) completed their studies and obtained the certificate, while 21 % did not finish the course.

*Practical Instruction.* — The School, under the Minister of Agriculture, has to train exclusively the technical assistants attached to the Bureau for Agricultural Hydraulics, the River Boards and the Water Companies. These assistants should be able to help in soil improvement work, defence against floods and to act as water-policemen. Thus the Bureau trains these "maîtres d'eau" primarily for State service. Candidates admitted for State services are taught and maintained without charge. It is only if places are available and on payment that technical employees of Water Companies or large estates are admitted.

The instruction is spread over 3 winter courses of 4 months each (Dec. 1 to April 1): in the interval the national Direction of the Water Department sends the candidates to various posts where they pass the summer performing the usual duties and carrying out easy operations.

The conditions of admission are, besides that of Hungarian nationality: the certificate of 2 classes at a secondary school or the rank of non-commissioned officer; age between 18 and 30 years; perfect knowledge of the Hungarian language. Non-commissioned officers from the army reserve of engineer corps and those that have carried out industrial work similar to that for the Water Service are given the preference for admission.

The annual budget of the School was, before the war, 26,000 *Kronen* including the cost of feeding internal students, lighting, heating, medical attendance, drawing instruments, books, etc. The State pays about 1200 *Kronen* for each pupil; in exchange the pupils already give useful service at the end of the first year and further are bound to serve the State for 3 years after leaving the School, or alternatively to pay an indemnity of

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(1) 1 gold Krone = 10 d. at par.

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1000 *Kronen* as a part return for the cost of their education. Those students that successfully complete their studies receive the diploma of "maître d'eau" of the State Hydraulic Department.

218 - **The Foundation of a National School of Veterinary Medicine in Mexico.**

— I. Decree for organising veterinary instruction, in *Boletín de la Dirección de Agricultura, Secretaría de Fomento, Colonización e Industria*, Year II, No. 1, pp. 9-10. Mexico, July, 1916. — II. Inauguration of the National School of Veterinary Medicine. *Ibid*, pp. 10-12.

By the decree of April 11, 1916, General VENUSTIANO CARRANZA has founded in Mexico a National School of Agriculture independent of the School of Agriculture. To be admitted, it is necessary to have taken the secondary education in an officially authorized school.

The course lasts four years. The school commenced work May 5, 1916.

219 - **The Activity, During the Agricultural Season 1914-1915, of the Various Technical Branches of the Agricultural Administration of Tunis.** —

*Bulletin Mensuel de la Direction générale de l'Agriculture, du Commerce, et de la Colonisation de la Régence de Tunis*, Year 20, No. 88, pp. 145-167. Tunis, 1916.

AGRICULTURAL  
INSTITUTIONS.

I. — BOTANICAL BRANCH — A. Cereals. — Comparative studies have been carried out on 22 varieties of hard wheat which were grown over 6.40 hectares (= 15.8 acres): the yields per hectare for the varieties tested were:

Turgid or Rivet wheat ( <i>Triticum turgidum</i> )	Derbessi ap 1 . . . . .	7	quintals per hectare (1)
	» ac 1 . . . . .	6	
	» ac 2 . . . . .	4	
	Realforte . . . . .	4	
True hard wheats ( <i>Triticum durum</i> )	Adjini ac 2 . . . . .	9	
	Sbei smooth tall . . . . .	6	
	Sbei pubescent tall . . . . .	6	
	Mahmoudi ap 4 . . . . .	7.85	
	» ac 2 . . . . .	3.82	
	» ac 3 . . . . .	9	
	Biskri smooth ac 2 . . . . .	9.70	
	Agili pubescent . . . . .	7.17	
	Souri ac 10 . . . . .	10	
	Souri ac 4 . . . . .	9.10	
	Mekki ac 2 . . . . .	9	
	Hamira ac 4 . . . . .	5.75	
	» ac 5 . . . . .	11	
	Medéa . . . . .	12	
	Azizi . . . . .	12	
	Jenah - Rhetifa ap 2 . . . . .	17	
	Taganrock . . . . .	8.65	
	Wheat No. 24 . . . . .	24.94	

(1) 1 quintal per hectare = 89.2 lbs. per acre.

Wheat No. 24 gave good results the year before, in spite of the drought; its defect is having the grain of a dull-grey colour.

Agriculturists received 3 300 kg. of seed, though 8 100 were asked for.

In addition, the pedigree cultivation has been undertaken of 20 new types of hard wheats representing unstudied Tunisian forms or coming from abroad, or new varieties found in the field and tested in the hope of finding the degree of fixity. For several years the influence of the size of the seed has been studied. In 1915, the following results were obtained:

		Yield per hectare		Ratio Grain: total yield
		Grain and straw	Grain alone	
Mahmoudi ap. 4	{ large seeds . . . . .	5 600 kg.	780 kg.	0.139
	{ small seeds . . . . .	4 400	760	0.172
Taganrok . . .	{ large seeds . . . . .	4 850	850	0.175
	{ small seeds . . . . .	4 530	880	0.194

It is concluded that the influence of the size of the seed on the yield is very small.

Similar experiments were carried out on 3 varieties of 'weak' wheats. The results were:

		Yield per hectare		Ratio Grain: total yield	Average yield of grain per hectare
		Grain and straw	Grain alone		
Richelle early	{ large grains (1.37 ha.) .	8 737 kg.	2 628 kg.	0.300	2 139 kg.
110 c	{ small grains (0.75 ha.) .	2 800	1 246	0.455	
Richelle late	{ large grains (1.10 ha.) .	3 890	1 135	0.292	956
109 b	{ small grains (0.50 ha.) .	2 100	560	0.267	
Mahow wheat	{ large grains (1.25 ha.) .	5 420	1 446	0.266	990
124 a	{ small grains (1.37 ha.) .	1 770	467	0.264	

The Tunisian agriculturists received 7 000 kg. of 'weak' seed wheat, 9 400 kg. having been asked for. Twelve 'weak' wheats were studied for pedigree. 10.95 hectares were sown for the production of seed barley, and 2 200 kg. of seed barley were distributed to the farmers, 5 100 kg. being asked for. Twenty-nine samples of oats of very varied origin, cultivated to find a dark coloured oat often appearing in Tunis, were studied for pedigree.

B. Forage Crops. — In particular, 4 varieties of forage peas coming from Svalöf Station (Sweden) were studied as they seemed of interest for Tunis; also two varieties of vetch from Svalöf, which were drought-resistant in 1914 and cropped well in 1915. A number of lucernes were collected from different countries: Argentine Republic (Rio Negro, Hungaro, La Pampa, Villarmo), Sweden (Svalöf), Greece (lucerne specially for dry soils), France and Peru; they gave good results.



A large number of native or foreign Gramineae and Leguminosae have been tested. In 1914, there were sown: 58 Tunisian Leguminosae, 140 Gramineae and 429 samples of leguminosae received from Botanical Gardens and Agricultural Stations all over the world.

C. Cotton. — The varieties tested gave the following results:

	Varieties	Raw Cotton per are	Ratio Cotton fibre: yield
Egyptian varieties . .	{ Assil (41 ares) (1) . . . . .	8.732 kg.	0.30
	{ Mt Afifi (35 ares) . . . . .	8	0.30
	{ Abassi . . . . .	—	0.30
	{ Janovitch . . . . .	—	0.30
	{ Sakallaridés . . . . .	—	0.31
Sicilian varieties . .	{ Biancavilla, white (9 ares) . . .	8.029	0.21
	{ Biancavilla, red . . . . .	—	0.20
	{ Mississipi . . . . .	—	0.24
American varieties . .	{ King . . . . .	—	0.27
	{ No. 3 . . . . .	—	0.29
	{ No. 14 . . . . .	—	0.24
	{ No. 16 . . . . .	—	0.29
	{ No. 17 . . . . .	—	0.25
	{ No. 25 . . . . .	—	0.30
Varieties from Turkestan	{ No. 2, white seeds (4 ares) . . .	7.180	0.28
	{ No. 3, green seeds (10 ares) . . .	8.485	0.24
	{ No. 3, white seeds (8 ares) . . .	8.184	0.25
	{ No. 4, bare seeds . . . . .	—	0.27

For the present the selection and separation of pure lines have had to be suspended.

II. — SOUTHERN EXPERIMENTAL GARDENS. — At the Experimental Garden at Gabes, fruit-bearing trees have been largely studied, especially as regards varieties and graft-bearers. Among other results, success has been attained with plantations of almonds, limes, olives (Zarazzi and Chemlali varieties). For the vine, it would be interesting to introduce varieties giving grapes for drying. The banana trials were very encouraging; but the musk variety from the Hama Experimental Garden (Algiers) has not as yet given the results expected of it.

At the same Experimental Garden studies were undertaken on varieties of potato for introduction in that region: the following varieties are recommended: Institut de Beauvais, Richter's Imperator, Blanche d'Italie and Saucisse rouge du Nord (also called Saucisse rouge d'Orléans).

In the *Sfax Experimental Garden* have been planted many fruit-trees: almond, peach, apricot, pistachio, carob, Japanese medlar-trees, etc.,

(1) 1 are =  $\frac{1}{100}$  th part of an hectare or 119.6 sq. yds.

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belonging to various varieties. In addition a small vineyard of some 120 feet has been planted with 40 varieties of table grape. The Garden has sold 2 000 almond-trees, 250 pear-trees, 150 apple-trees, 150 peach-trees and nectarines, 25 plum-trees, 150 carob-trees in pots and 50 pistachio-trees in pots. Most of the almond-trees were delivered to European colonists; on the other hand, the natives appear most interested in early varieties of peach, pear and apple-trees from the Experimental Garden.

## CROPS AND CULTIVATION.

AGRICULTURAL  
METEOROLOGY

- 220 — **Effect of Meteorological Factors on the Germination Capacity of Seeds.** — WALIDEN, J. N., in *Sveriges Utsaedeförenings Tidskrift*, Year XXVI, No. 4, pp. 146-162, 4 fig. Malmö, 1916.

It is necessary, in the present article, to bear in mind what the writer understands by "germination capacity". It is quite possible that seeds possessing high germinating power and strong germinating energy may, after germinating perfectly normally, later show evident symptoms of weakness with various checks and defects of growth.

When the writer speaks of a seed germinating well, he means to convey not only the fact that it develops rapidly and regularly but also produces sturdy seedlings.

Meteorological variations at the time of maturation of the seeds have a very evident effect on the germination capacity. Copious rain and a low temperature during the period of ripening and harvest stimulate the development of the grain, which subsequently germinates in storage or even in the shock. The degree of sensitiveness varies according to the species but is maximum in rye, which two days rain are sufficient to germinate. For wheat, barley, oats, marked differences are noted between different varieties. Among the most sensitive varieties of wheat may be cited Wilhelmina, Extra-Squarehead I and especially Pudel; Extra-Squarehead III, Sol, Bore and Grenadier, on the other hand, are much more resistant. Among the most sensitive varieties of barley are Svanhals and Gull; among the least sensitive Prinzess, Chevalier, Primus and Hannchen.

Analogous differences are observed between the various kinds of oats: in cases of excessive rain at the time of harvest Gullregn, Ligowo and Klock even sprout in the ear, while Krom, Seger, Bortslös, Probsteier and Stormogul resist much longer.

Premature germination naturally influences the germinating capacity, as understood in the wider sense; grains which have begun to germinate in the ear only continue with difficulty at seeding time and at the best of times only produce weak and malformed seedlings.

If rain is a determining factor, the question arises whether the tendency to early development is influenced by the meteorological factors predominating at the time of harvest. The answer is in the affirmative; grains formed during dry weather germinate better than those formed during rain. The point is that in the latter case the seeds are not properly ripe when harvested.

In July 1914 (the ripening period in Southern Sweden) there were only 57.1 mm. of rain (in 9 wet days) and there were 221 hours of sunshine with average daily temperature of  $23^{\circ}$  C. The month was therefore a dry and hot one. On the other hand, in 1915, the data were as follows: 114.1 mm. distributed over 22 rainy days, 110 hours of sunshine and an average temperature of  $17^{\circ}$  C. The month was thus cold and wet. The seed harvested in 1915 showed much less tendency to germinate than that of 1914.

The rapidity with which the germinating point is reached is not only subject to the influence of the temperature during the period of ripening but is also dependent upon the specific properties of the different varieties.

Tables I and II show, for certain varieties of wheat and barley, the percentages of grains ripe for germination. These percentages were determined at the same given moment – mid-September for wheat – early December for barley.

The time required for reaching the degree of ripeness requisite for germination is shorter in proportion as the seed is drier. It must be noted, however, that this point is not reached immediately after shrinking, which proves that the ripening process is not merely the mechanical result of loss of water but depends upon biochemical changes occurring within the grain.

How can the above facts be turned to the practical help of the farmer? At any rate we can see that varieties, the seeds of which are slow in reaching germination maturity (e. g. Sol), should be sown immediately after harvesting, otherwise they germinate too late and, with the advent of winter, the seedlings are weak, under-developed and more sensitive to the action of frosts and low temperatures.

In oats, the inner situated caryopsis (the smaller) matures earlier than the outer and, if the seed is not sorted with proper care, the seedlings develop very irregularly and the field looks very patchy.

In cold regions with an early winter it is consequently advisable to dispose of types of cereals which reach the degree of maturity necessary for germination as early as possible. The seedlings then appear in time



TABLE I. — *Percentage of grains ripe for germination in certain varieties of wheat at Svalöf, 1915.*

0-10 %	10-20 %	20-30 %	30-40 %	40-50 %	50-60 %
Thule Wilhelmina Fylgid Sammet	Extra-Squarehead II Pansar Pudel	Sol II 0904 Extra-Squarehead III Små	Thule Små + Sol 0921 Bore	Renodlad-Squarehead Grenadier III Sol II	Sol Små × Sol 0920

TABLE II. — *Percentage of grains ripe for germination in certain varieties of barley, at Svalöf, 1915.*

0-10 %	10-20 %	20-30 %	30-40 %	40-50 %	50-60 %	60-70 %	70-80 %
Strain 0246 Hviderup	Gull	Svanhals Strain 0178 Hviderup	Primus	Chevalier II	Prinzess Chevalier	—	Strain 0185 Hviderup

and at the commencement of the cold weather are already sufficiently developed and have acquired a considerable degree of resistance. On the other hand, the early maturing varieties are the ones most sensitive to rain and have a tendency to sprout in the ear or shock.

As a consequence of the above it is necessary in selection work to adhere to an average type, and this has been done at Svalöf. Sol wheat is too late. Sol II is much earlier, specially the 0904 strain. On the other hand, Pudel is somewhat too early and inclined to germinate in the ear; by crossing with Sammet a somewhat later type has been obtained: Thule.

Crossing Extra-Squarehead I with Grenadier has given Extra-Squarehead II, a good type with intermediate characters which correct the excessive earliness of Extra-Squarehead I.

221 - **Influence of Meteorological Factors on the Development and Yield of the Millets *Panicum miliaceum* and *Setaria italica*, in Russia.** — SIRIUSOV, M. G., in Труды по сельско хозяйственной Метеорологии (*Work on Agricultural Meteorology*), No. XVI, pp. 118-131, 6 fig. Petrograd, 1916.

Owing to its marked resistance to drought, millet is particularly well adapted to farming conditions in South Russia, where its cultivation is being extended every year. It may, indeed, reach as far as the banks

of the Western Dvina but in proportion as it progresses towards north and west so its value and importance gradually diminish owing to the progressive diminution of the grain yield. The present paper gives the results of a series of researches made by the author with the object of studying the specific action of meteorological factors upon the development of millet at the Agricultural Experiment Station of Temir, district of Turgai. In addition to the variety commonly cultivated in this region various other botanical types with constant and well defined characters were examined. The cultivated types, as it happens, are composed of a mixture of forms with sometimes opposing characters, so much so that the action of a specific meteorological character upon the yield may remain completely hidden. Among the botanical varieties introduced in the course of the experiment are: *Panicum miliaceum nutans* var. *victoriae*, *Panicum miliaceum compactum* var. *dacicum* and "Sultan" millet, which is a kind of *Setaria italica*.

If an identical type of plant be sown at different periods, the different phases of development, occurring at different moments, will coincide with distinct meteorological values, and if any relationship exists between the yield and the course of meteorological phenomena, the grain yield in the various groups of plants should show considerable fluctuations.

In the present case, sowing was done at 4 different times: Ist group: April 23 - II<sup>nd</sup> group: May 3 - III<sup>rd</sup> group: May 13 - IV<sup>th</sup> group: May 24.

TABLE I. — Summarises the yields per acre.

Kinds	Seedling groups			
	I	II	III	IV
	lbs.	lbs.	lbs.	lbs.
Common. . . . .	1 713	1 525	1 552	1 365
<i>Panicum miliaceum nutans</i> var. <i>victoriae</i> . .	3 211	2 208	1 606	1 499
<i>Panicum miliaceum compactum</i> var. <i>dacicum</i> :	2 211	1 713	1 606	2 043
"Sultan" millet . . . . .	1 499	602	401	1 3/4

"Sultan" millet gave the most striking results; the delay in sowing involves progressive diminution in the yield, which drops from 1 499 to 602 and then to 401, while the plants of the IV<sup>th</sup> group hardly gave any ripe grain whatsoever. Similar results, though less distinct, are observed for *Panicum miliaceum nutans* and for *P. m. compactum* var. *dacicum*, whilst for the commonly grown variety the fluctuations are feeble and uncertain. This is due to the fact that this variety is composed of a number of varied forms, reacting often in contradictory manner to a particular meteorological factor and so producing a kind of compensation.

In the comparative study of the physiological and meteorological data, the writer has considered the following phases of development: 1) first appearance of seedlings; 2) expanding of 3rd leaf; 3) expanding of 5th leaf; 4) stooling; 5) earing or emergence of inflorescence from sheath; 6) flowering; 7) milk ripeness; 8) complete maturity of grain. The appearance of the 3rd leaf coincides with the first growth outline and development of the lateral rootlets. If, at this moment, the meteorological factors are unfavourable, the rootlets develop very slowly, no root hairs are formed and the plant is only fixed loosely in the soil so that at the smallest blow the plant bends and topples over. Table III gives data relating to temperature, mean readings and the total number of degrees distributed over 8 successive periods of development: 1) from sowing to the first appearance of the young plants; 2) from the appearance of the young plants to the development of the 3rd leaf; 3) from the development of the 3rd leaf to that of the 5th; 4) from the development of the 5th leaf to the stooling phase; 5) from stooling to emergence of inflorescence; 6) from emergence of inflorescence to flowering; 7) from flowering to milk-ripeness; 8) from milk-ripeness to complete maturity.

TABLE II. — *Data on temperature.*

Period of development	Group I			Group II			Group III			Group IV		
	Duration of period in days	Sum of temperatures	Mean temperature	Duration of period in days	Sum of temperatures	Mean temperature	Duration of period in days	Sum of temperature	Mean temperature	Duration of period in days	Sum of temperatures	Mean temperature
1st . . . . .	14	140 <sup>0</sup> .2	10 <sup>0</sup> .0	11	181 <sup>0</sup> .4	16 <sup>0</sup> .5	8	166 <sup>0</sup> .8	20 <sup>0</sup> .8	10	154 <sup>0</sup> .2	15 <sup>0</sup> .4
2nd . . . . .	4	61 <sup>0</sup> .6	15 <sup>0</sup> .4	4	72 <sup>0</sup> .8	18 <sup>0</sup> .2	6	97 <sup>0</sup> .3	16 <sup>0</sup> .2	3	48 <sup>0</sup> .0	16 <sup>0</sup> .0
3rd . . . . .	5	88 <sup>0</sup> .0	17 <sup>0</sup> .6	6	90 <sup>0</sup> .3	15 <sup>0</sup> .1	7	116 <sup>0</sup> .2	16 <sup>0</sup> .2	5	109 <sup>0</sup> .5	21 <sup>0</sup> .9
4th . . . . .	6	84 <sup>0</sup> .8	14 <sup>0</sup> .1	2(?)	28 <sup>0</sup> .3	10 <sup>0</sup> .1	5	112 <sup>0</sup> .0	22 <sup>0</sup> .0	5	110 <sup>0</sup> .1	22 <sup>0</sup> .0
5th . . . . .	26	439 <sup>0</sup> .0	16 <sup>0</sup> .9	25	469 <sup>0</sup> .5	18 <sup>0</sup> .7	19	386 <sup>0</sup> .1	20 <sup>0</sup> .3	22	479 <sup>0</sup> .6	21 <sup>0</sup> .8
6th . . . . .	9	171 <sup>0</sup> .3	19 <sup>0</sup> .0	7	124 <sup>0</sup> .0	17 <sup>0</sup> .7	5	96 <sup>0</sup> .3	19 <sup>0</sup> .2	8	166 <sup>0</sup> .5	20 <sup>0</sup> .8
7th . . . . .	14	322 <sup>0</sup> .0	23 <sup>0</sup> .0	15	350 <sup>0</sup> .4	23 <sup>0</sup> .0	18	427 <sup>0</sup> .1	23 <sup>0</sup> .7	18	441 <sup>0</sup> .2	24 <sup>0</sup> .5
8th . . . . .	18	910 <sup>0</sup> .3	22 <sup>0</sup> .8	19	462 <sup>0</sup> .8	24 <sup>0</sup> .4	20	496 <sup>0</sup> .3	24 <sup>0</sup> .8	15	337 <sup>0</sup> .4	22 <sup>0</sup> .5
	96	722 <sup>0</sup> .0	17 <sup>0</sup> .9	89	779 <sup>0</sup> .5	20 <sup>0</sup> .0	88	1 898 <sup>0</sup> .1	21 <sup>0</sup> .5	86	1 856 <sup>0</sup> .0	21 <sup>0</sup> .5

The most important results may be summarised as follows:

1) Germination only takes place when the mean soil temperature (24 hours) at the spot where the grains are situated is not below 10-12° C. The higher the temperature the more rapid are germination and growth.



In 1914, during the period between sowing and first appearance of the young plants, the temperature was an average one:  $10^{\circ}\text{C}$  for the Ist group,  $16^{\circ}.5$  for the IInd,  $20^{\circ}.8$  for the IIIRD. Corresponding to these data the length of the period diminished, from 14 days to only 8 days. In 1915, with groups sown at 7 different periods, still more striking results were obtained: the period required between sowing and appearance of the seedlings being rapidly shortened. This is due to the course of the spring season with accompanying rise of temperature; the periods are: 20 - 18 - 13 - 6 - 5 - 4 - 3 days.

2) Thermal conditions have a clear influence on the flowering phase, which is more rapid the greater the daily rise and fall of temperature. During the 14th and 15th July 1914, hourly determinations were made of temperature, the thermometers being held at a height of 71 cms. above the ground, i. e. at the level of the inflorescence. From  $5^{\circ}\text{C}$  at 4 a. m. the temperature rose to  $30^{\circ}.3\text{C}$  at 2 p. m.; at 11 a. m., at a temperature of  $30^{\circ}\text{C}$ , notwithstanding the night had been very cold, 135 to 140 flowers opened simultaneously.

3) The rainfall values are spread over various periods of development. In this case, 6 periods only are distinguished, instead of 8; they are: 1) sowing; 2) appearance of young plants; 3) development of the 3rd leaf - stooling; 4) stooling - earing; 5) earing - flowering; 6) flowering - complete maturity.

TABLE III. — *Data on Rainfall.*

Periods of development	Seeding groups			
	I	II	III	IV
Ist . . . . .	11.2 mm	3.7 mm	2.1 mm	46.3 mm
2nd . . . . .	—	2.1	23.2	17.1
3rd . . . . .	2.1	27.1	17.1	2.1
4th . . . . .	61.6	35.8	10.6	10.6
5th . . . . .	10.6	10.6	—	—
6th . . . . .	2.4	2.6	5.8	9.5

The critical period for millet with respect to rainfall coincides with the stooling phase, although it is not yet exactly known whether the notable need of water by the plant at this moment is to be correlated with the actual stooling process or with the development of the lateral rootlets.

4) In the atmospheric layer where the millet develops its epigeal portions (stem and flowers), the plant itself takes special precautions thanks to which the meteorological factors are modified and fixed as the result of quite special combinations and relationships. It creates a kind of

*micro-climate*. This results from hourly observations on the temperature and humidity of the atmosphere by means of instruments situated amongst the crop. Minima thermometers were employed, one placed at the surface of the soil and the others at 18 — 36 — 53 — 71 cm above, and also a hygroscope placed at 35 cm. above soil level.

SOIL PHYSICS,  
CHEMISTRY  
AND  
MICROBIOLOGY

222—**Water Penetration in the "Gumbo" Soils of the Bellefourche Reclamation Project, South Dakota, United-States.** — MATHEWS, O. R. in *U. S. Department of Agriculture, Bulletin*, No. 447, 12 pp. 4 fig. Washington, D. C., November 2, 1916.

The readiness with which water penetrates into any soil determines to a great extent the amount that will be available to crops. An accurate knowledge of water movement within a soil often furnishes an indication of the farm practices that will be most successful. Thus, under irrigation the rapidity of water percolation may determine in what way and at what time water may be most effectively applied. On dry land a knowledge of moisture movement often shows what results may be expected from different cultural methods calculated to increase the quantity of water entering the soil.

The gumbo soil of the Belle Fourche (S. Dak.) Reclamation Project offers problems in water penetration materially different from those in soils of other types. These differences are due largely to its peculiar physical characteristics.

This bulletin presents the results of certain studies of the penetration of water into the gumbo soils of the Belle Fourche project.

Water movement in the gumbo soils of the Belle Fourche Reclamation Project may be summed up as follows:

On a dry soil, penetration takes place rapidly to a depth of about 2 feet because of the cracked condition of the soil near the surface. After the layer of easily penetrated soil becomes wet, it becomes so swollen and compact that it is nearly impervious, and further water movement is very slow.

The fact that moisture can move only very slowly in the wet surface soil would make it necessary to run water over the soil for a very long time in order that any considerable portion might be absorbed. This is not practicable, for the experiment with a dry subsoil showed that water from the surface penetrated almost as deep in a few minutes as it did in 10 days, so that the increase in the amount of moisture absorbed where the water stands for any considerable length of time over that taken in when the soil is simply covered would be so small as to be negligible. After a field has once been covered with water little benefit can result from allowing the water to stand on or flow over the soil.

It is interesting to note the radical difference in water absorption between this soil and the sandy loam soil at Scottsbluff. The maximum rate of absorption is obtained on the wet soil at Scottsbluff and on the dry

soil on the Belle Fourche project. These diametric differences apparently are due to the physical differences between the two soils and show clearly that a satisfactory practice on one type of soil may not be equally successful under other soil conditions.

The results of these experiments and observations can easily be applied in field practice, and recommendations for methods and practices may be based upon them.

The following points relative to the application of water by irrigation to these gumbo soils are clearly shown:

- 1) Water should be applied only when the surface is dry.
- 2) The quantity of water absorbed will depend upon the dryness and the cracked condition of the surface soil.
- 3) After a field has once been covered with water, little further absorption takes place, and no benefit can result from having water stand on or flow over soil which was previously dry and cracked.

The following points brought out in this bulletin apply to the cultural practices for these gumbo soils either under irrigation or dry land conditions:

1) No particular method of cultivation will be superior to others in influencing the quantity of water absorbed, since this depends upon the degree to which the surface soil is dry and cracked. The soil after harvest is usually so dry that atmospheric falls are absorbed, regardless of the cultural treatment.

2) Since the dry soil is naturally broken up to depths as great as would be reached by either deep plowing or subsoiling, these operations can be of no great benefit in water absorption.

3) Some method, such as dynamiting, by which the soil below the cracked area could be broken up, might result in a temporary increase in the depth to which water could easily penetrate. The natural swelling of the soil, however, would cause it to become compact again every time it was wet. This would make it necessary for the operation to be repeated each year. The expense such a method would entail would be so great that, from a practical point of view, it would not be possible to consider it seriously.

223 - **Draining and Cultivation of the Poitevin Marsh, France.** — WELSH JULES, in *Annales de Géographie*, Jear XXV, No. 137, pp. 325-346, 3 fig. Paris, 1916.

PERMANENT  
IMPROVEMENT,  
DRAINAGE AND  
IRRIGATION.

The writer, professor of geology at the University of Poitiers, gives an account of the features of the Poitevin Marsh, a plain 185 250 acres in extent and of low altitude, situated in the Deux-Sèvres, la Vendée and the Charente-Inférieure, along the littoral. It is an old gulf which has been filled up since Tertiary times by Quaternary and Recent marine and river alluvia. The marine alluvia predominate, forming the "bri"



of the peasants. It is a marly *Scrobicularia* (1) clay of modern formation. To the north-west, the Marsh is bounded by dunes, also of quite recent formation. It is a formation analagous to those of the other coastal marshes (Aunis and Saintonge, Marais de Dol in France; *polders* in Belgium and Holland; Thames marshes and Fens in England, etc.).

The dunes, posterior to the "bri", protect the Marsh from the sea; they have often been strengthened by dykes. In certain parts they are covered by pine forests; in others nothing but Marram grass (*Ammophila arenaria*) is grown. Certain portions have long been in demand for market gardens: the fields are "buried", that is to say a portion of the sand is removed in order to get nearer to the moist layer, the higher borders acting as a protection against the sea winds.

The inner portion of the Marsh is next examined by the writer, where the thickness of the "bri" is very variable, in some spots reaching as much as 28 metres. The surface, in the hollows, has been covered with modern alluvia formed of a clayey-sandy silt, often containing vegetable remains. The soil so formed is a blackish grey vegetable earth, spongy and finely divided, in great demand for certain crops, especially beans.

In order to exploit the Marsh, both the fresh water and the sea have had to be contended with. Dykes extending further and further westward have been built as a protection against the sea: 1 kilometre has been gained in the course of a century. The Isle of la Dive, near Cape Aiguillon, which in 1755 did not yet form a part of the coast, is now in the middle of the Marsh. Draining has had to be carried out as a protection against the fresh water: the "bri" being impermeable, the level of the small watercourses tends to rise after rain and to submerge the country. These small watercourses have had to be dyked and closed by sluices in order to prevent the tide from driving back the fresh water.

In order to carry out the work of draining, a portion of marsh was chosen untraversed by streams and with a natural tendency towards drying. This was then surrounded with a dyke or "bot" and within the area so enclosed ditches were dug in order to carry off the enclosed water.

The slope on the external face of the "bot" is steeper than that on the inner face. On the inner side it is accompanied by a ditch known as a "contrebot", on the outer by another called "achenal". The portion contained within the "bot" is the drained or dried Marsh; that

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(1) The writer proposes the adoption of this term (used in England since 1868 for similar deposits) in order to denote the formation or deposits of marine muds which have filled the inlets of the French littoral since the end of the quaternary period. *Scrobicularia plana* (*piperata*) is an edible bivalve mollusc, known as "lavagnon" or "lavignon" by the fishermen.

without is the "wild" or wet Marsh, which serves as an overflow bed for the rivers in times of flood. The writer gives a very complete historical review of the progress of draining since the Gallo-Roman period.

The whole of the artificial channels for carrying off the water are practically without "drop", if not carefully looked after they would rapidly become choked. Necessity has bred a spirit of cooperation among the peasants of the "Plaine" who are also proprietors of the Marsh. A whole system of associations, syndicates etc. has been gradually created since the middle ages for the protection of wet and drained marshes, the upkeep of the ditches and the removal of weeds in dry years. The State bears a portion of the cost of this important work.

Thanks to the above transformation, malarial fever has disappeared and the whole of the Marsh is under cultivation. The dried marshes possess no trees and practically no houses (1). Cereals are the chief crops: wheat, oats and legumes: garden and field-beans. Fertiliser is supplied by the cleanings from the ditches. A certain portion is left as natural pasture and serves to rear horses and horned cattle. The level of the wet marshes is generally lower than that of the dry. For a long time the former were abandoned to aquatic plants; the inhabitants living in huts built of reeds and clay. All this was transformed during the course of the 19<sup>th</sup> century when dykes were made separated, from which the earth necessary for their construction was taken. Upon the embankments ("terrées") and mounds ("mottes") so formed trees were planted: willow, ash, osier, poplar. In the drier portions are cultivated flax and hemp, beans, beets; the area of pasture has increased considerably since 1866-1890, owing to the development of cooperative butter factories. Certain wet marshes which in 1840 were only worth £4.16s. 3d. per acre now fetch ten and even twenty times that amount. Market gardens (*terre chambaude*) have been formed everywhere. At the present day the area of wet marsh is 61 750 acres and of drained marsh 98 800 acres. The value of the latter exceeds 120 million francs, the former having an equal or even greater value.

In conclusion, the writer gives an account of the intensive use of the water courses as a means of transport. The paper contains references to a very large number of works dealing with the Poitevin Marsh.

224. - **Irrigation Work in Chili.** OPAZO, ROBERTO G., in *El Agricultor*, pp. 272-274, 5 fig. Santiago de Chile, November, 1916.

The land actually under cultivation in Central Chili covers 15 045 871 hectares (2), of which 1 067 003 are irrigated, and 1 000 000 capable of

(1) Wood is so rare in the western portion of the Marsh that animal dung is preserved for drying in the spring and burning as a kind of peat.

(2) 1 hectare = 2.4711 acres.

(Ed.)

irrigation. The forests from Malleco to the South are not included in the area under cultivation. Irrigation is of great importance to Chili where the rainfall is practically entirely restricted to the winter season and the summers are very long and hot. Irrigation work was begun more than a century ago with the construction of the Maipo canal, following which many other small irrigation works were carried out by private persons. Lately, law No. 2953 has ordered the construction of 4 large irrigation canals. Among these latter, the Manco canal, in the province of Valparaiso, is already well on the way to completion, the surveys of the Maule and Laja canals are finished and those of the Melado canal in the province of Linares are well forward. These 4 canals will irrigate an area of 120 000 hectares. Further, several projects for dams are under consideration. Among these is one on La Laguna, a tributary of the Elqui or Coquimbo, which will permit of the impounding of 40 000 000 cubic metres of water and of the irrigation of the Elqui valley, more than 20 000 hectares. In the province of Santiago, the Yeso dam will be able to hold up more than 200 million cubic metres of water to organise the district served by the Maisso and to ensure a supply of water to a canal which will irrigate the Department of Melpilla. The survey of the irrigation works for the Polpaico valley, a little to the north of Santiago, is already very well forward, thanks to the possibility of using the waters of the Aconcagua. Finally, there is the project for regularising the Teno, which irrigates the province of Curico, and that for the Mondaca, a tributary of the Lontué which will allow of the irrigated area in the province of Talca being greatly extended. The plans relating to this last project are executed by the "Inspección general de riegos",.

225. — **Researches on the Method used for Determining the Water-content and the Dry Matter in Vegetable Products** (1) LEBEDIANZEV A. N. and ZALYGUINE G. I. (*Chemical Laboratory of the Schatilovskaia Agricultural Station, Russia*) in Журналь Опытной Агрономии имени И. С. Коссовича (*Review of Experimental Agriculture dedicated to the memory of P. S. KOSSOVITCH*), Vol. XVII, Part 3, pp. 181-130. Petrograd, 1916.

The results of analyses of vegetable products are often related to the dry matter, considered as such when at "constant weight". In this connection the writers had much difficulty during their work in 1915: they could not obtain a "constant weight" by drying vegetable matter; losses continued to take place for an indefinite period, resulting that no data could be obtained to show that the water was completely eliminated. This fact induced the writers to study the value of the ordinary method used to determine the content of water and dry matter, which consisted in

(1) See also *B.*, January, 1917, No. 19.

(Ed.)



drying the vegetable matter at a high temperature ( $100^{\circ}$ – $105^{\circ}$  C or  $105^{\circ}$ – $110^{\circ}$  C) in an ordinary steam-oven, till of "constant weight".

The work was divided into three parts as follows:

*Part I:* The writers attempted to define with the utmost precision the fundamental fact of the continued loss of weight of the substance at  $100^{\circ}$  C in air. At the same time they determined the products eliminated to find out the proportion of water.

*Part II:* They studied the changes during decomposition of vegetable matter when the temperature and pressure are changed and the air is replaced by carbon dioxide.

In the first and second parts they studied one plant only, viz. young wheat, being unstable and thus being specially suitable for these researches.

*Part III:* The writers also studied other plants so as to permit of generalising their conclusions.

In the first part, the substance to be dried was placed in a glass U tube with a ground stopper, and which was placed in a glycerine bath warmed to a given temperature. A current of warm air, with its water and  $\text{CO}_2$  removed by passing through calcium chloride, concentrated sulphuric acid and caustic soda, was passed through the U tube; after passing through this the air went through 3 U tubes full of calcium chloride, then through an apparatus containing caustic soda in solution and in small pieces.

RESULTS OF THE RESEARCHES. — During drying of the young wheat plants it was noticed that from the beginning, besides the water, carbon dioxide was given off as well as some organic compounds that might alter the results of both acids as well as normal alkalis. In addition there was reason for thinking that part of the decomposition products might be retained by the calcium chloride, the latter absorbing them more rapidly than water. In every case the loss of weight of the dried substance is smaller than the increase in weight of the absorption apparatus, which makes it seem likely that oxidation and hydration play a part in the decomposition.

These observations agree with these of BERTHELOT on the elimination of carbon dioxide from vegetable matter.

The decomposition of the vegetable matter of the young wheat plants during drying at  $100^{\circ}$  C increases greatly; the losses of weight of the substance and the increase in weight of the absorption apparatus were recorded for 66 hours. This prolonged decomposition does not agree with BERTHELOT'S results, but it is conformed by those of other authors.

The following changes: lowering the drying temperature to 80 and  $60^{\circ}$  C — decreased pressure — replacing the oxygen by a stream of  $\text{CO}_2$  — varying the time the gas passes through the drying substance — have no definite influence on the rate of decomposition; in every case the loss in weight of the drying substance continued uninterruptedly for a long time.

The amount of loss depends chiefly on the drying temperature and relatively little on the quickness of elimination of water vapour. The diminution of pressure and the absence of oxygen had no apparent effect. The importance of the temperature is so great that each given temperature corresponds to a given amount of loss, which cannot be obtained from a lower temperature no matter how long the time.

At the normal temperature in a dessicator containing sulphuric acid and phosphorus anhydride, the vegetable matter continued to lose weight during 4 to 7 months, then a state of equilibrium was set up which may not be the end of the decomposition.

These phenomena of indefinitely prolonged decomposition during drying are not only seen in young wheat, but also in young winter rye and oats, and the winters have also found them in adult plants: winter rye - oats - flax - potato tubers - mangold roots - clover - lucerne - vetch. The young shoots are the most liable to this decomposition, especially those of winter wheat: in 33 hours of drying, after eliminating the water, they lost about 1.6 % of their weight, whilst adult plants did not lose more than 0.6 %. Amongst the latter the least resistant are beets, clover and lucerne, as shown in the following table, where the losses of weight for the first 9 hours of drying have been taken as 100, so as to correlate the loss of weight in various successive periods of time.

*Losses in weight during drying for various adult plants, correlated with the losses for the first 9 hours taken as 100.*

Hours of drying	Rye	Oats	Flax	Potato tubers	Beets (roots)	Clover	Lucerne	Vetch
0-9	100	100	100	100	100	100	100	100
9-27	2.45	2.24	+ 0.62*	1.64	10.14	3.26	3.46	1.60
27-42	2.32	2.77	3.72	1.98	6.97	3.67	3.32	2.95
9-42	4.77	4.01	3.10	3.62	17.11	6.93	6.78	4.5

\* The sign + shows an increase in weight.

CONCLUSIONS. — The determination of the water in vegetable matter has a double aim: 1) to find the amount of water itself; 2) to obtain figures relating to the dry matter content, by eliminating the water as not being connected with the fundamental properties of vegetable matter.

The results of these researches have shown that the present method for finding the water content does not fulfill these two aims. In fact, the actual water content is not known, as the elimination during drying is not pure water, but is a mixture of water and decomposition products of the

vegetable matter, and the residue after drying is not the pure dry matter but is more or less oxidised and hydrated. Again these methods are too inaccurate to give comparable results: for the idea of "constant weight," under its apparent accuracy, prevents the exact comparison of a number of analyses from different sources, because the various manipulators prolong the period of drying more or less according to their personal views.

To eliminate these inconveniences, the writers propose to all analysts of vegetable matter: 1) to consider the usual method for determining the water content as *conventional* and to abandon completely the ideas of "constant weight" and "hygroscopic water"; 2) to decide the type of water oven to be used, as well as other details of the determination.

226 - **The Chemical Composition of the Mulberry Leaf.** — See No. 267 of this *Bulletin*.

227 - **On the Resistance of Plants to Withering.** — CAVARA, F. and PARISI, R. in *Bollettino dell'Orto Botanico de la R. Università di Napoli*, Vol. V, pp. 261-273. Naples, 1916.

The results of a series of experiments made by the 2 writers in the Botanic Garden of the University of Naples, in order to study the resistance of plants to withering, as well as its relationship to the nature and structure of the soil (period 1915-1916).

PLANTS EXAMINED: Mustard (*Sinapis alba*); Bean (*Vicia Faba*); Chick pea (*Cicer arietinum*); Cotton (*Gossypium herbaceum*); Wheat (*Triticum vulgare*); Castor oil plant (*Ricinus communis*); Maize (*Zea Mays*); American Sorrel (*Rumex vesicarius*); Tripolitan Barley (*Hordeum vulgare*); Sea Daffodil (*Pancratium maritimum*).

The experiments were started in the summer of 1915. Cylindrical glass jars holding about 49 cub. ins, were used, being filled with various soils, previously dried, and chosen according to practical criteria: soils were chosen either of workable nature, or of notorious sterility, such as the sands and red earths of Tripoli.

To each jar 25 cc. of water were given to each 6 cub. in of earth. Five days after sowing or planting and as soon germination had commenced, each jar was weighed. The weighing was repeated every 5 or 6 days until evident signs of withering were observable, when the plant was removed. Then the dry weight and the water content of the soil were determined. According to the writers, it is not accurate to define the remaining moisture alone as the *withering coefficient*, without taking into account the number of days of growth of the plant up to withering. On the contrary, the figures for the growth in length and the dry weight of the plants have less importance for a short experiment and in a limited amount of earth. The most important experimental results are summed up as follows:



**DURATION OF GROWTH UP TO WITHERING.** — The length of the resistance varies with the soils and is related to the poverty or richness in organic matter that modifies the water capacity of the soils, and with the water content of the atmosphere.

It is usually shorter in sandy soils such as the red soils of Tripoli, sea or river sands, pozzolona. There is an average of 20 days during the summer-autumn period of 1915 for the laboratory experiments, while there is an average of 28.5 days for silicious soils containing more or less humus, such as the soil of the Naples Botanic Garden and two soils from Pomigliano d'Arco.

**THE HUMIDITY REMAINING IN THE SOIL.** — The humidity remaining in the soil shows important variations, either as to the soil structure, or relatively to the hygroscopic state of the air; while it increases with the increase of soil humus, it decreases when the moisture content of the air increases. The averages are: for sandy soils, 2.518 grms % (1915) and 3.040 grms % (1916) and for humous soils, respectively 6.891 grms and 6.935 grms %.

**THE LENGTH REACHED BY THE PLANTS.** — There are only slight differences in the average lengths in relation to the various types of soil. In fact, for the laboratory tests in 1915, an average was reached of 15.08 cm. for sandy and 15.82 for humous soils. In the 1916 tests, the average was 25.75 cm. for sands and 23.13 cm. for the humous soils.

**DRY WEIGHT OF THE PLANTS.** — Results obtained by weighing show higher and higher averages for plants grown in sandy soils, as against those from humous soils. This may perhaps be attributed to a larger development of mechanical tissues in the plants from sandy soil, and parenchymatous tissues etc. from those of humous soils.

**SPECIFIC BEHAVIOUR OF THE PLANTS.** — The resistance of plants to withering may be deduced from the time elapsing between germination and withering, as well as from the way the water given was used, indicated by the water remaining in the soil after the withering of the plant. But, by following these criteria, one is led to accept the idea of a specific behaviour, which becomes more evident on taking averages for each plant both of the duration in days and the water content remaining.

TABLE I. — *Average duration.*

1915 Tests		1916 Tests		Glass-house tests (1915-1916)	
Mustard . . . . .	24 days	Bean . . . . .	28.5 days	Wheat . . . . .	60.5 days
Bean . . . . .	19.5 »	Chick Pea . . . . .	30 »	Barley . . . . .	67.5 »
Cotton . . . . .	21 »	Maize . . . . .	24 »	American Sorrel . . . . .	84.5 »
Wheat . . . . .	28 »	Castor oil plant . . . . .	35 »	Sea Daffodil . . . . .	100 »
Chick Pea . . . . .	27.5 »				
Maize . . . . .	38.5 »				
Castor oil plant . . . . .	35 »				

From the figures in Table I, it is seen that in the various experiments, there is a notable difference of duration between a minimum of 19.5 days (Bean, 1915) and a maximum of 100 days (Sea Daffodil 1915-1916, in glass-house).

TABLE II. — *Average remaining humidity.*

1915 Tests	1916 Tests	Glass-house tests (1915-1916)
Mustard . . . 3.516 grm %	Bean . . . . 3.830 grm %	Wheat . . . . 2.950 grm %
Bean . . . . 5.000 »	Chick Pea . . 8.655 »	Barley . . . . 2.830 »
Cotton . . . . 5.574 »	Maize . . . . 11.405 »	American Sorrel 2.645 »
Wheat . . . . 4.925 »	Castor oil plant 4.965 »	Sea Daffodil . 0.663 »
Chick Pea . . 4.035 »		
Maize . . . . 7.570 »		
Castor oil plant 5.545 »		

The figures of Table II show a very different specific behaviour for the different plants, for they may vary from a minimum of 0.663 grm % (Sea Daffodil) to a maximum of 11.405 grm % (Maize, 1916). Thus one gets specific values that are notably different both as regards the duration of the plants and the utilisation of the water.

## 228 - The Function of Anabiosis in the Hibernation of Winter Grain Crops.

— SABACHNIKOV, V. in Журнал Опытной Агрономии имени П. С. Коссовича (*Review of Experimental Agronomy dedicated to the memory of P. S. KOSSOVITCH*), Vol. XVII, No. 4, pp. 334-335. Petrograd, 1916.

The writer summarises the observations and theories of A. STEBOUT on the question of the hibernation of winter sowings.

According to STEBOUT the degree of the winter check depends largely upon the variety. Observations at the Saratov Agronomical Station have shown that during the winter 1914-1915, plants with an erect system of stooling succumbed whilst those with a spreading system withstood the cold well and gave a crop.

The samples from the collection of winter wheats harvested in 1914 at the Saratov Station behaved differently during the autumn of the same year; notwithstanding the favourable conditions of temperature and moisture the plants resulting from these seed samples suspended growth in length and seemed to concentrate their activity on preparing for hibernation. On the other hand, several other types from this collection continued to grow, possibly with less energy as the temperature gradually fell, but in any case without definitely reaching the growth suspension

stage; apparently these types were not preparing for hibernation but had merely suspended their *ordinary* physiological processes on account of lowering of temperature.

In order to explain this difference, the writer considers that the suspension of autumnal development of winter wheats may be the result either of a simple reaction against lowering of temperature, or else from the passing of the plants to the *anabiotic* state, analogous to the anabiosis of animal organisms (1).

(1) In a paper entitled « Anabiosis and its importance in agriculture » Сельское Хозяйство Лесоводство *Agriculture and Sylviculture*, Vol. CCXL, Year LXXII, pp. 345-354. Petrograd, November 1912, P. BAKHMETIEV describes the method he employed in order to induce, under the action of low temperatures, the anabiotic state in an animal, i. e. the state in which the animal no longer gives any evidence of life.

A given animal *B* is placed in an air bath (fig. 1) surrounded by a mixture of pounded ice and salt; the water resulting from the melting of the ice is eliminated by the siphon *C*; the temperature within the recipient is lowered to  $-22^{\circ}$  C. The temperature of the animal is measured with the aid of an electric thermometer composed of two fine metallic threads *a* and *b* (one of iron, the other of nickel), soldered together at one extremity which is then inserted in the back of the animal *B*, if an insect, or in the anus if it is a mouse, for instance. The free ends of both threads are then connected to a sensitive mirror galvanometer.

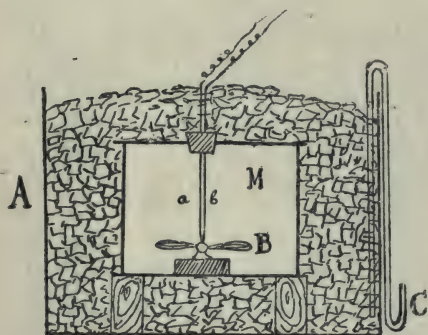


Fig. 1. — BAKHMETIEV'S apparatus for experiments on animal anabiosis (B = body of an insect).

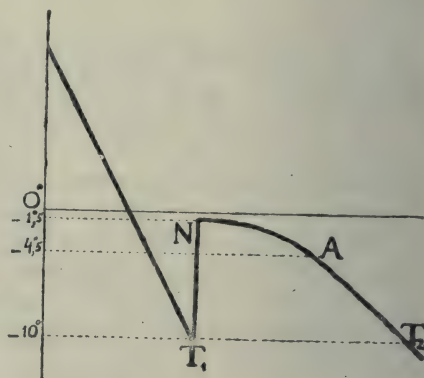


Fig. 2. — Temperature curve of an animal under experiment (AT<sub>2</sub> = anabiotic state).

Shortly after the animal has been placed in the cold air bath, readings of its temperature must be made at intervals of one minute: at first the temperature falls in regular fashion but no sooner has it reached the point  $T_1$  (which, for insects,\* is in the neighbourhood of  $-10^{\circ}$  C) than it makes a sudden jump to *N*, about  $-1.5^{\circ}$  C. For a few minutes the thermometer remains stationary at this point, after which it begins to fall



It is thus legitimate to suppose that the various types of cereals are capable of differing with regard to the anabiotic state: thus, those cereals which are incapable of assuming this state must often fall easy victims to the cold.

Such types are probably most frequently encountered among the oats, barleys and winter wheats distributed over the southern part of Russia; these are, at bottom, "spring" cereals but require to be sown early as they need low temperatures if their later development is to be stimulated in normal fashion.

On the other hand, the varieties which are capable of assuming the anabiotic state may support even very severe winters, and the more thorough the anabiosis the easier they will do so.

slowly (fig. 2). When the temperature reaches  $-4^{\circ}.5$  C. the writer has shown that all the liquids contained within the animal body solidify.

This marks the beginning of what the writer calls the *anabiotic* state, where circulation, respiration and nutrition completely cease. If, subsequently, the temperature falls as low as the point  $T_2$  (usually  $-10^{\circ}$  C) the animal will perish.

The limits of the anabiotic state thus being the point  $A$  ( $-4^{\circ}.5$ ) and the point  $T_2$  (about  $-10^{\circ}$ ), in order to revive the animal it must be withdrawn from the first air bath when its body temperature falls between these limits, e. g. at  $-7^{\circ}$  and placed in another air bath the temperature of which is more or less constant between the limits  $-5^{\circ}$  and  $-9^{\circ}$ . The animal may be kept for any period without dying. If it is removed and kept at room temperature it will revive.

To sum up, P. BAKHMETEV defines the anabiotic state as the state of interruption of the vital functions prior to the resumption of the same.

In Dr. HEINRICH SCHMIDT'S *Wörterbuch der Biologie* (Leipzig, 1912) on page 15, under the heading ANABIOSIS one reads: « Many invertebrates (or their germs) possess the faculty of passing through periods of extreme drought or excessive cold in a state of apparent death, and of subsequently resuming life when the environmental conditions are more favourable.

This reawakening to life is termed *Anabiosis* and animals possessing this faculty are said to be *anabiotic*.

In the NOUVEAU LAROUSSE ILLUSTRÉ, ANABIOSIS is defined as follows: « (from the Greek ἀναβίωσις = resurrection); return to life, after an interruption of the vital functions presenting more or less the character of death. *Anabiosis* is very common in the plant kingdom. See REVIVISCENCE (synonym).

Under this heading one also sees: « Dessicated organisms no longer show any of the characters proper to living beings: their state is intermediate between life and death; it is the *latent death* of CLAUDE BERNARD, the *apparent death* of the Germans, the *anabiosis* of PREYER. It must be interpreted as a protective acquisition of organisms exposed to alternative conditions of drought and humidity ».

In FUNK'S STANDARD DICTIONARY OF ENGLISH LANGUAGE (London and New York, 1911) ANABIOSIS is defined thus: « (from the greek ἀναβίω = to resuscitate); a coming to life again, resurrection » — ANABIOTIC: medical term; restoring animation, acting as a stimulant.

Numerous observations justify the supposition that for these types the critical period is not winter but spring, that is to say, the season in which they lose their faculty of anabiotic defence as a result of the awakening of their vital functions.

229 - **Effect of Sodium Salts in Water Cultures on the Absorption of Plant Food by Wheat Seedlings** - BREAZEALE, J. F., in *Journal of Agricultural Research*, Vol. VII, No. 9, pp. 407-416. Washington, D. C. November 27, 1916.

These experiments were undertaken to determine the extent to which the presence of the various sodium salts commonly found in alkali soils affects the absorption of plant-food elements by wheat seedlings.

*Sodium salts used:* chloride, sulphate and carbonate in concentrations ranging from 50 to 1000 parts per million in solution by weight.

*Standard nutrient solution* of 200 p. p. m. of  $\text{NO}_3$  as sodium nitrate, 200 p. p. m. of  $\text{K}_2\text{O}$  as potassium chloride and 130 p. p. m. of  $\text{P}_2\text{O}_5$  as sodium phosphate together with calcium carbonate in excess.

*Variety studied.* « Minnesota Bluestem » C. I. 169. *Triticum vulgare*.

The percentage of nitrogen absorbed does not appear to be measurably modified by the presence of any of the sodium salts investigated in concentrations up to 1000 p. p. m. Sodium chloride in these concentrations does not affect the absorption of phosphoric acid to any noticeable extent, but slightly depresses the percentage of potash absorbed, as is shown by Table I.

TABLE I. — *Effect of sodium chloride and sodium sulphate on the absorption of nutrients by wheat seedlings.*

Culture No.	Sodium chloride				Sodium sulphate			
	Sodium chloride added to nutrient solution	Elements absorbed from solution (in % of dry weight of plants)			Sodium sulphate added to nutrient solution	Elements absorbed from solution (in % of dry weight of plants)		
		N.	$\text{K}_2\text{O}$	$\text{P}_2\text{O}_5$		N.	$\text{K}_2\text{O}$	$\text{P}_2\text{O}_5$
	P. p. m.	—	—	—	P. p. m.	—	—	—
1. . .	0	3.1	6.3	1.7	0	2.8	6.0	2.0
2. . .	50	3.3	5.5	1.7	50	2.1	5.7	2.1
3. . .	100	3.6	5.7	1.9	100	1.8	5.6	1.9
4. . .	200	3.5	5.9	1.8	200	2.3	6.4	1.9
5. . .	300	3.6	5.5	1.9	300	2.4	5.8	1.8
6. . .	400	3.0	4.5	1.5	400	2.2	5.7	1.6
7. . .	500	3.5	6.6	2.1	500	2.5	5.1	1.7
8. . .	1000	3.0	5.5	1.7	1000	2.2	4.0	1.4

Sodium sulphate distinctly depresses the absorption of potash and of phosphoric acid, sodium carbonate causes a more marked depression in the absorption of both potash and phosphoric acid, as is seen from Table II.

TABLE II. — *Effect of sodium carbonate on the absorption of nutrients by wheat seedlings.*

Culture No.	Sodium carbonate added to nutrient solution P. p. m.	Elements absorbed solution (in % of dry weight of plants)		
		N.	K <sub>2</sub> O	P <sub>2</sub> O <sub>5</sub>
1. . . . .	0	1.4	5.6	1.9
2. . . . .	50	1.6	5.6	1.7
3. . . . .	100	2.2	5.5	1.7
4. . . . .	200	2.3	5.9	1.6
5. . . . .	300	1.9	5.2	1.4
6. . . . .	400	3.0	4.2	0.8
7. . . . .	500	1.3	2.5	0.7
8. . . . .	1000	1.4	1.0	0.4

The depressing effect of sodium carbonate is shown in concentrations as low as 100 p. p. m. The presence of even minute amounts of sodium carbonate in the soil may have a marked deleterious effect upon the metabolism of small-grain crops, especially during germination, since at that time the seedlings require to absorb a large quantity of potash.

#### 230 - The Assimilation of Nutrients by the Rice Plant: Studies made in India.

— GATINDRA NATH SEN in *Agricultural Research Institute, Pusa, Bulletin* No. 65. pp. 1-13. Calcutta 1916.

The result of experiments in the assimilation of nutrients by the roots, culms, leaves and seeds of the rice plant. The samples were taken at different stages: — I. very young seedlings — II. seedlings ready for transplanting — III. adult plants in pre-flowering stage — IV. plants beginning to flower — V. grain in milk stage — VI. plants ready for harvest — VII. plants in dead ripe stage.

*Nitrogen.* — During the very young seedling stage, the roots contain 2 per cent of nitrogen which falls during the 2nd stage to 1 per cent, during the 3rd stage to 0.74 per cent, and during the 4th stage when the grain is scarcely formed to 0.52 per cent, at which figure it remains practically constant until the plant is quite ripe.



In the above-ground parts of the plant, as in the roots, the nitrogen percentage diminishes as the plant advances in age. It decreases from 3.48 per cent in the very young seedling, to 0.80 per cent at the time of harvest. The fall is especially rapid between the 1st and 2nd stages, during which interval the nitrogen content decreases from 3.48 per cent to 1.34 per cent. During the 2nd and 3rd stages, the leaves are much richer in nitrogen than the stems (2.11 — 0.77 and 1.44 — 0.79 per cent respectively). As the ears form, both the leaves and the stems lose their nitrogen. The nitrogen accumulates most in the grain (1.6 per cent), while all the other parts of the plant contain practically the same amount (0.5 per cent).

*Phosphoric acid.* — In the roots, the percentages of phosphoric acid fall as the plant advances in age: from 0.37 per cent in very young seedlings to 0.15 per cent in ripe plants. In the above-ground parts, on the other hand, the phosphoric acid content decreases from 0.40 per cent in the young seedling to 0.22 per cent in the plant just before flowering, but rises again when the grains fill up (in the early stages of the ripening of the grain it reaches 0.38 per cent) to fall again to 0.26 per cent at the time of harvest. Till about the time that the flowers appear, the roots and the above-ground parts are about equally rich in phosphoric acid. With the emergence of the panicle, the phosphoric acid accumulates more in the above-ground parts than in the roots.

As the ears mature, there is an accumulation of phosphoric acid in the grain, while the other parts of the plant become poorer, all ultimately containing about the same percentage: 0.15.

*Potash.* — The percentages of potash in the roots are the same in the first and second stages (1.85 — 1.91 per cent). Afterwards, they decrease progressively, falling to 0.66 at the time of harvest.

The percentage of potash in the leaves and stems, on the other hand, reaches its maximum in the third stage, before the adult plant has yet flowered (3.13 per cent).

Assuming the average yield of dry grain to be about 900 lb. per acre, it is seen that, neglecting the amounts absorbed by the stubble and the roots, such a crop removes from the soil 29.33 lb. nitrogen, 9.64 lb. phosphoric acid and 49.69 lb. potash. These figures give an idea of the amount of manure required by rice.

Since practically all the nitrogen, phosphoric acid and potash are absorbed by the plant in the early stages of its growth, it is essential that manure should be applied in good time. Later on, during the stages following transplanting, manures might be of indirect advantage, but after the formation of the ears, the amounts of plant food material taken up would be negligible, as the absorption processes then are superseded by assimilation and the translocation of the materials absorbed which continue to accumulate in the grain.

231 - **Studies on Oat Breeding in Maine, United States. Selection within Pure Lines.** - SURFACE, M., FRANK, and PEARL, RAYMOND, in *Maine Agricultural Experiment Station, Bulletin* 235, pp. 1-40, Orono, Maine 1915.

PLANT  
BREEDING

Previous to 1910, it was almost universally assumed that small fluctuating variations were, to some extent at least, inherited. It was further believed that such variations were cumulative in effect, and that substantial progress in breeding in a desired direction could be made by selecting in successive generations, those individuals showing the given character in the most pronounced fashion.

But DE VRIES' mutation theory and the study of MENDEL's law have shown that variations caused by external conditions are not transmitted in any degree from one generation to another, and that individual characters, both in animals and plants, are inherited as units. The germ plasm is no longer regarded as a plastic substance that can be moulded by the environment, or by selection, but rather as a mosaic made up of a vast number of definite, stable units. As small fluctuating variations due to changes in environment in no way influence these independent units, they cannot be inherited.

In 1903, as a result of many experiments, JOHANNSEN announced that in self-fertilised plants there was no effect of selection within a "pure line".

He defined a "pure line" as the offspring of a single, self-fertilised, homozygotic individual

The article analysed gives the results of 3 successive years of selection within pure lines of oats; 20 pure lines representing 13 varieties were used and over 12 500 plants.

The characters studied were weight of grain - weight of plant and of straw - height of plant - number of culms, and the correlation between the number of culms and their length and grain yield.

*Grain Yield.* - In the case of each line, the selection was carried out in 2 opposite directions: from each generation were selected the most productive individuals (the positive, or + deviations) and the least productive individuals (negative, or - deviations) for the purpose of calculating the plus, or minus, deviations in the successive generations. Finally, in each of the two groups, the rows of plus deviations and those of minus deviations were estimated. Table I summarises the results produced in 3 succeeding generations by selecting individuals having a larger, and those having a smaller, yield than the average plants of the row examined. In 1912, there were 82 lines grown from plus selections made in 1911, i. e., from plants whose yield was above the average of their respective pure parents. Likewise there were 74 rows from minus selections made in 1911. The 82 plus selections showed an average plus deviation of 9.02 gm. per plant, that is to say, each plant weighed on an average, 9.02 gm. more than the parent plant selected in 1911.

On the other hand, on the 74 rows from the minus selections, the average minus deviation is 5.92 gm. per plant.

Of the 82 first lines there were 44 rows with a total plus deviation of 58.42 gm. while the 38 other rows had a total minus deviation of 42.53 gm. There is thus a difference of 15.89 gm. due to selection.

In the same way, of the 74 second lines, 41 showed a total minus deviation of 53.33 gm, and the other 33, a total plus deviation of 37.62 gm. viz., a difference of 15.71 gm. due to selection.

There is therefore apparently a decided effect of the selection made in 1911 upon plants grown in 1912, but in the writer's opinion, it is rather a physiological than a genetic effect. It is possible that the larger, and consequently more vigorous plants, produce grain which has more nourishment, or which for some other reason, gives the new plant a better start. In fact, in the 2nd year, 1913, the effects of the selection in 1911 were already less, and in 1914, they had completely disappeared. Further, the plus selections showed a deviation in the direction opposite to the selection, just as the minus selections gave rise to individuals with higher yields.

In 1914, of the 84 lines produced from the seed of individuals selected in 1911 for their greater productivity, 38.5 gave a total positive deviation of 50.88 gm, while the 45.5 others showed a total negative deviation of 56.84 gm, or a negative difference of 5.96 gm.

On the other hand, of the 94 lines of plants of low yield 49 gave a total negative deviation of 61.04 gm. and the remaining 45 a total positive deviation of 66.91 gm, or a positive difference of 5.87 gm.

Thus, in the 3rd year; selection which was practised with the intention of obtaining increasingly productive, or increasingly unproductive, types respectively, produced exactly the opposite results.

If the positive effects of the selection of small fluctuations in the 1st generation were due to a true change in the germ plasm, the results obtained would be evident after 2 or 3 selections in the same direction, where — as the exact opposite is the case.

*Height of plants.* — The analysis of the selections for height of plants shows the same results as were found for grain yield. Table II sets forth the effect of the 1911 selection of the taller, or shorter, individuals belonging to the 1912, 1913 and 1914 generations.

*Conclusion.* — The writer concludes from the data obtained from these experiments, which lasted for 3 years and were based upon, and controlled by, biometrical laws and formulae, that the selection of fluctuations leads to no positive results.



TABLE I. — *The effects of the 1911 plus and minus selection (for grain yield) in the three succeeding years. Deviations in gms*

		Selected Plants		Daughter Row			
				+ Selections		— Selections	
		+	—	+ Deviations	— Deviations	+ Deviations	— Deviations
1912	{ Number of rows . . . .	82	74	44	38	33	41
	{ Total deviation . . . .	739.88 gm	437.93 gm	58.42 gm	42.53 gm	37.62 gm	53.33 gm
	{ Average deviation per row	9.023 gm	5.919 gm	1.328 gm	1.119 gm	1.14 gm	1.301 gm
1913	{ Number of rows . . . .	126	132	53	73	58.5	73.5
	{ Total deviation . . . .	1272.71 gm	821.60 gm	58.38 gm	56.24 gm	54.03 gm	56.19 gm
	{ Average deviation per row	10.101 gm	6.224 gm	1.102 gm	0.77 gm	0.924 gm	0.765 gm
1914	{ Number of rows . . . .	84	54	38.5	45.5	45	49
	{ Total deviation . . . .	909.88 gm	590.18 gm	50.88 gm	56.84 gm	66.91 gm	61.04 gm
	{ Average deviation per row	10.832 gm	6.279 gm	1.337 gm	1.249 gm	1.487 gm	1.246 gm

TABLE II. — *Effect of the 1911 selections for Height of Plant upon the Rows in each of the three succeeding years. Deviations in centimetres.*

		Selected Plants		Daughter Row			
				+ Selections		— Selections	
		+	—	+ Deviations	— Deviations	+ Deviations	— Deviations
1912	{ Number of rows . . . .	86	70	44	42	35	35
	{ Total deviation . . . .	393.35 cm.	420.53 cm.	180.65 cm.	166.00 cm.	121.77 cm.	136.39 cm.
	{ Average deviation . . . .	4.574 cm.	6.008 cm.	4.105cm.	3.952cm.	3.478cm.	3.897cm.
1913	{ Number of rows . . . .	130	126	61	69	71	55
	{ Total deviation . . . .	566.58 cm.	697.39 cm.	277.19 cm.	267.83 cm.	249.56 cm.	258.50 cm.
	{ Average deviation . . . .	4.356 cm.	5.535 m.	4.544cm.	3.882cm.	3.515cm.	4.700cm.
1914	{ Number of rows . . . .	76	102	34	44	52	50
	{ Total deviation . . . .	335.07 cm.	726.39 cm.	117.45 cm.	125.67 cm.	194.54 cm.	186.31 cm.
	{ Average deviation . . . .	4.409 cm.	7.121 cm.	3.454cm.	2.991cm.	3.741cm.	3.726cm.

232 - **A Genetic Study of Plant Height in *Phaseolus vulgaris*.** — EMERSON R. A., in *Bulletin of the Agricultural Station of Nebraska*, No. 7, pp. 3-73, fig. 16. Lincoln, 1916.

In *Phaseolus vulgaris* the habit of growth, the number of internodes, and the length of the internodes, are 3 characters which are correlated with one another and with the height of the plant.

In a series of crossing experiments carried out with the greatest care

at the Agricultural Experiment Station of Nebraska (United States), the writer has studied the nature and behaviour of these characters to the third generation of hybrids. GROWTH HABIT — Common beans are of 2 distinct types with respect to habit of growth: they are either determinate, or indeterminate. In the former type, the growth of the plant ceases on the development of a terminal inflorescence and the number of internodes never exceeds 8; while in the latter, the flower clusters are inserted laterally in the nodes, and the growth of the axis is terminated only by accident, unfavourable surroundings, the drain of seed production and the like. For the sake of simplicity, the terms "bush" and "pole" are substituted for "determinate" and "indeterminate".

If we assume that the character of indeterminate growth is due to the presence of a factor ( $A$ ) and the character of determinate growth to the absence of this factor ( $a$ ), then as every individual is due to the fusion of the sexual elements of both parents, the pole beans may be represented by the formula  $AA$  and the bush beans by the formula  $aa$ .

On crossing  $AA$  with  $aa$ , we shall obtain for the hybrids of the  $F_1$  generation, the formulae  $Aa$ , or  $aA$ . What will be the behaviour of these hybrids? We might theoretically predict that they would be intermediate, that is to say, plants of determinate growth, in which, however, the terminal inflorescence would appear much later, not till from 15 to 20 internodes had been formed. But, on the contrary, all the 981 individuals of the  $F_1$  generation, showed the indeterminate type of growth. Thus  $A$  is dominant as regards  $a$ .

The examination of the hybrids of the 2nd generation confirms what has been said above. For if  $A$  and  $a$  were equally potent, the fusion of  $Aa$  with  $aA$  would produce:  $AA$ ,  $aA$ ,  $Aa$ ,  $aa$ , that is to say  $1/4$  of the descendants would be like one parent,  $1/4$  would be like the other, and  $1/2$  would be of intermediate character. From 1 104  $F_2$  (2nd hybrid generation) plants, the writer, however, obtained 832 indeterminate and 272 determinate in growth, a ratio of 3.01 : 0.99, which is very near the theoretic ratio of 3 : 1. It can be said then, by way of conclusion, that in *Phaseolus vulgaris*, indeterminate and determinate habits of growth constitute a simple mendelian character-pair with indeterminate habit completely dominant.

LENGTH OF INTERNODES. — On crossing the pole bean, "Snowflake", (average length of internodes  $22.5 \pm 0.32$  mm.) with the bush bean, "Tallbush", (average length of internodes  $44.76 \pm 0.93$  mm.) the internode length of the hybrids of the  $F_1$  generation was distinctly intermediate ( $29.62 \pm 0.59$  mm.), while in the  $F_2$  generation it was very variable, but always within the extremes of the parent plants. On the other hand, the height of the  $F_1$  plants was by no means intermediate between the parents, nor was the  $F_2$  range in height confined to the parental extremes. In

other words, in the  $F_2$  generation, some of the plants were shorter, and others taller than either of the parents. It appears a clear inference from these data, that a tall race of bush beans (like "Tallbush"), which inherited its relatively great height from a tall pole-bean parent of an earlier cross, has transmitted tallness to its pole-bean progeny of the  $F_2$  generation when crossed with a very short pole-bean (like "Snowflake"). Other factors for height of plant are, then, inherited independently of habit of growth.

NUMBER OF INTERNODES. — The observations made on this subject have led to the same conclusion as the study of the length of the internodes. The genetic factors concerned in the determination of number of internodes in bean plants are distinct from factors for habit of growth and are inherited independently. It is possible, from a cross between a pure strain of bush beans and a pure strain of pole-beans to isolate types both of bush and poles-beans with other internode numbers than those of the parent races. There are thus, at least, 3 factors influencing the height of the plant of *Phaseolus vulgaris* and though they can be transmitted independently of one another, they necessarily influence one another during the development of the plant. But the action of the factor *A* is dominant and suppresses the factors *B*, *C* etc., of which the effect is only seen in the variations occurring in the  $F_2$  generation. A combination of the multiple-factor and the single-factor hypotheses best interprets and explains the phenomena treated above. If we adopt the single-factor theory and try to interpret according to it the variation in the  $F_2$  hybrids, we shall be obliged to admit that the potency of this factor can be modified and remodified in the most different and inadmissible ways, while on the other hand, the theory of multiple-factors cannot explain the mendelian regularity of the segregation of characters in the  $F_1$  and  $F_2$  generations.

233 - **Some Recent Investigations in Sugar - Beet Breeding in the United States.** — PRITCHARD, J. FREDERICK, in *The Botanical Gazette*, Vol LXII, No. 6, pp. 423-465, XXXII Tables, 51 fig., Chicago, Illinois, December 1916.

The selection and improvement of sugar-beets based on the determination of the roots with the highest sugar content is a task requiring a large amount of analytic work. This is shown by the records of a single European beet-seed Company which analyses over 300,000 individual beets a year. It has, however, apparently been assumed upon theoretical grounds that a high percentage of sugar tends to be transmitted, without regard to the possibility of its being a fluctuating character and therefore not transmissible.

The writer has tried by means of numerous researches and experiments, to establish a more economical method of selection based on the selection of characters and on a more exact knowledge of the principles and laws of heredity.



The material employed consisted of:

- (1) An American variety of sugar-beet known as « Morrison's Kleinwanzleben ».
- (2) An unnamed variety obtained at Madison by making selections from 11 foreign varieties (« Madison Original Selections »).
- (3) Five South Dakota varieties bred for several years at Brookings.
- (4) An old well-established European variety « Kleinwanzleben's Original ». This variety is very uniform, most highly bred and very widely used and was employed by the writer for the purposes of control and comparison.

Most of the data given in the graphs, except where it is specially stated, refer to « Morrison's Kleinwanzleben ».

CORRELATION BETWEEN SEED YIELD IN MOTHER BEETS AND THE SUGAR CONTENT OF THEIR PROGENY. — Positive correlation between extractable sugar and seed yield would constitute a very desirable relationship, as it would permit of the two characters being combined in a single

TABLE I. — *Correlation between the seed yield of the mother root and the Sugar Content of the succeeding Generation.*

*Seed yield of the mother-beets (from 25 to 25 g).*

	162.5	187.5	212.5	237.5	262.5	287.5	312.5	337.5	362.5	387.5	412.5	No. of descen- dents
13.0	1	1										2
13.5	4	1		1								6
14.0	3	1	1	3	3			1				12
14.5	9	5	1	1		2						18
15.0	6	2	4	2	1							15
15.5	10	9	5	4	1							29
16.0	3	8	2	3			1	1			1	19
16.5	8	3	3	2	1							17
17.0	3	1										4
17.5	1	1			1							3
Totals of descen- dants	48	32	16	16	7	2	1	2	0	0	1	125

TABLE II. — *Correlation between the Mother Beets and Their Progeny from the Point of View of the following characters: "Percentage of sugar — amount of sugar per root — Weight of root."*

Characters compared	Coefficients of correlation		
Percentage of sugar in mother root . . . . .	(1908-1910)*	(1912-1914)	
Average percentage of sugar in progeny . . . . .	— $0.149 \pm 0.067$	— $0.090 \pm 0.076$	
Amount of sugar in mother root . . . . .	(1908-1910)	(1906-1908)	(1907-1909)
Amount of sugar in progeny. . . . .	$0.082 \pm 0.050$	— $0.100 \pm 0.088$	$0.104 \pm 0.044$
Weight of mother root . . . . .	(1906-1908)	(1908-1910)	
Average percentage of sugar in progeny . . . . .	$0.168 \pm 0.086$	$0.055 \pm 0.054$	
Weight of mother root . . . . .	(1908-1910)	(1906-1908)	
Amount of sugar per root in progeny. . . . .	$0.092 \pm 0.055$	— $0.115 \pm 0.087$	
Weight of mother root . . . . .	(1908-1910)	(1906-1908)	
Average weight of root of progeny	$0.023 \pm 0.056$	— $0.095 \pm 0.089$	

\* Of the two dates in brackets, the first refers to the mother-beet and the second to its progeny.

type and gradually improved. On the other hand, a negative correlation would lead to selection of roots with small seed yield. What is of importance is not so much the correlation of these two characters in the mother beet, as the correlation between the seed yield of the mother root and the sugar content of the succeeding generation. A glance at table I (page 366) shows that the percentage and quantity of sugar varies in an irregular manner. There is therefore no correlation between the above mentioned characters, so extensive selections may be made for freer seed production without danger of sugar deterioration.

TRANSMISSION OF SELECTED QUALITIES OF MOTHER ROOTS. — The selection of mother roots for the purpose of starting a new family of beets, or improving one already established, is usually made upon the basis of size, shape and percentage of sugar. Little is so far known as to the transmission of these characters. In the early period of beet breeding they appeared to improve through selection, but this was at a time when the material was very variable and full of distinct physiological species. Now, the poorer physiological species have been eliminated and the few good varieties characterised by size, shape and sugar content have been retained.

The result of this selection is, that all varieties are now very much alike; moreover such root characters as size and sugar content, are markedly influenced by the environment, which causes considerable fluctuations that are not transmitted. Table II (page 367), which gives a summary of the biometrical data regarding the abovementioned characters, shows that there is no correlation between percentage of sugar, weight, or sugar content of the root and the average value of the same quality in its progeny. In fact, the poorest roots make as good progeny records as the best roots. Therefore the customary practice of selecting mother roots by current physical and chemical means is no more effective, and is a much more costly method than taking roots at random.

TRANSMISSION OF CHARACTERS OF SELECTED FAMILIES. — Average root weight, and average sugar percentage are the two characters deciding the relative value of families of beets grown under identical conditions. But these characters are easily modified by external agencies, and the fluctuations greatly exceed the real differences between sugar-beet families, so that it appears impossible for the characters of each family to be transmitted.

The results of numerous data collected by the writer are as follows :

1) From the point of view of the percentage of sugar there is no correlation between the individuals of 2 successive generations as this example shows :

	Average percentage of sugar in beet root families		Coefficient of correlation
In 1912. . . . .	14. 07 $\pm$ 0. 063	} . . . . .	0. 229 $\pm$ 0. 072
In 1914. . . . .	31. 61 $\pm$ 0. 074		

2) From the point of view of the amount of sugar per root, there is also no correlation between successive generations :

	Average amount of sugar per root in beet families (in ounces)		Coefficient of correlation
n 1908. . . . .	2. 33 $\pm$ 0. 014	} . . . . .	0. 031 $\pm$ 0. 060
In 1910. . . . .	3. 69 $\pm$ 0. 042		

3) There is no appreciable correlation between the average weight of root of the parents and the average percentage of sugar in their descendants.

			Coefficient of correlation
Average weight of root in ounces in beet families in 1906 . .	18. 8 $\pm$ 0. 391	} . . . . .	0. 056 $\pm$ 0. 091
Average percentage of sugar in beet families in 1908 . . .	21. 7 $\pm$ 0. 077		



4) From the point of view of the average root weight there is no correlation in succeeding generations.

	Average weight of root (in ounces) in beet families	Coefficient of correlation
In 1908. . . . .	10. 74 $\pm$ 0. 067	— 0. 003 $\pm$ 0. 059
In 1910. . . . .	20. 57 $\pm$ 0. 261	

We are not justified by these facts in concluding that no real differences in yield and quality occur, however, as real differences may be obscured by fluctuations. The most we can say at present is that family differences of this character, as determined by current field methods, are not permanent.

DETERIORATION FROM LACK OF SELECTION. — There is a current belief that sugar-beets deteriorate in percentage of sugar when selection is discontinued, but this has not been proved satisfactorily. A *gradual decrease* for a limited period is not necessarily indicative of *permanent reduction*, as such environmental factors as sunshine, temperature, rainfall, time of planting, fertility of the soil, drainage and cultural methods, all vary in different years and these variations affect the percentage of sugar, which

TABLE III. — *Comparison of Morrison's selected mother beet seed with Morrison's commercial seed.*

Morrison's Selected Mother-Beet Seed				Morrison's Commercial Seed			
Row number	No. of beets in row	Weight of row of beets (in pounds)	Percentage of sugar in beets	Row number	No. of beets in row	Weight of row of beets (in pounds)	Percentage of sugar in beets
2	68	46. 5	15. 0	3	67	43. 5	15. 9
4	68	37. 0	15. 0	5	65	32. 5	15. 2
6	60	39. 5	15. 2	7	62	37. 0	15. 4
8	72	40. 0	15. 1	9	70	39. 5	15. 5
10	62	38. 0	15. 2	11	72	43. 0	15. 3
12	82	47. 0	14. 9	13	69	36. 5	15. 7
14	85	49. 5	15. 0	15	57	33. 0	15. 7
16	74	45. 0	14. 9	—	—	—	—
Averages	71. 4	42. 8	15. 0	Averages	66	38. 0	15. 5

may fall for 2 or 3 consecutive seasons, and then rise again under more favourable conditions.

If sugar-beets deteriorate from lack of selection, commercial seed should produce poorer roots than the seed of selected mothers. In order to decide this question, a comparison was made in 1913 by mixing seed of highly selected families of Morrison's "Kleinwanzleben" and planting it beside the commercial variety of the same stock. The results are given in Table III (Page 369). In every case the commercial seed produced the roots richest in sugar, but they were somewhat smaller than roots from the seed of selected mothers (average difference 11.79 gm. per plant), but this is equivalent only to about 0.03 per cent sugar, while the average difference obtained was 0.5. Thus the commercial seed appeared to improve.

From these observations it may be concluded that continuous selection of variations in no way improves the useful characters of the beet-root, since these differences are mere fluctuations, due to external causes, and are therefore not transmissible.

AGRICULTURAL  
SEEDS

234 — **Production of Seed of Sugar Beet in Russia.** — I. Production of Sugar Beet Seed in Russia by selection of seeds produced in the country, in Приложения къ представленной въ министерство Земледѣлія докладной запискѣ Правленія Южно-Русскаго Общества Поощренія Земледѣлія и Сельской Промышленности по вопросу о мѣрахъ къ обезпеченію Россіи свекловичнымъ посѣвнымъ маточнымъ матеріаломъ. (*Appendices to the Report presented to the Ministry of Agriculture by the Direction of the Society of Southern Russia for the encouragement of agriculture and agricultural industries, on the question of providing Russia with sugar beet seed from local picked sources*), pp. 1-164. Kiev, 1916. — II. (KRIUKOV, N. A.), Sugar Beet Seed in Russia, in Земледѣльческа Газета (*The Agricultural Gazette*, No. 38 (154), pp. 1018-1020. Petrograd, 1916. — III. Present state of plant-breeding in the Government of Podolia, in Подольскій Хосѣинь (*The Podolian Agriculturist*), No. 78, pp. 17-22. Vinniza, 1916.

I. — According to this Report, the world's production and consumption of sugar beet seed for the last few years has been as shown in Table I.

The above table shows that the production of commercial sugar beet seed is essentially concentrated in two countries; Russia and Germany, and their united production represents 9/10ths of that of the whole world.

Table II gives an idea of the development of this branch in Russia. It has been compiled by the Department of Customs and relates to the period 1900-1913; in addition to the total figures, those for Germany and Austria are also given. According to this table, Russia who, at the beginning of the period 1900-1913 imported sugar beet seed, has now become an exporter.

If the two principal characters only of the sugar beet be considered, sugar content and sugar production per unit of area, 3 periods may be

TABLE I. — *World's production and consumption of commercial seed of sugar beet.*

	Production	Consumption
Germany . . . . .	573 300 quintals	147 420 quintals
Russia . . . . .	365 270	286 650
Austria . . . . .	49 100	131 640
Holland . . . . .	4 900	14 740
France . . . . .	8 190	57 330
Denmark . . . . .	2 460	8 190
Belgium . . . . .	—	13 100
Italy . . . . .	—	13 100
Spain . . . . .	—	12 280
Sweden . . . . .	—	6 550
Roumania . . . . .	—	4 900
Switzerland . . . . .	—	290
Serbia . . . . .	—	980
Bulgaria . . . . .	—	1 310
England . . . . .	—	410
America . . . . .	—	81 900
	1 003 220 quintals	780 790 quintals

TABLE II. — *Russian trade in seeds of sugar beet from 1900 to 1913.*

Year	Imports				Exports			
	Quantity of grain in thousands of quintals (1)			Total value in thousands of francs (2)	Quantity of grain in thousands of quintals (1)			Total value in thousands of francs (2)
	Total	Germany	Austria		Total	Germany	Austria	
1900 . . . .	45	36	7	1 806	2	0.5	1	119
1901 . . . .	36	32	4	1 420	4	0.6	3	170
1902 . . . .	36	31	4	1 350	2	0.8	2	178
1903 . . . .	18	16	4	617	3	1.3	16	127
1904 . . . .	18	15	2	481	3	3	1	125
1905 . . . .	11	7	3	420	9	2	8	952
1906 . . . .	7	5	2	473	3	0.5	3	111
1907 . . . .	9	5	4	356	4	0.6	3	109
1908 . . . .	8	5	2	276	4	0.7	3	149
1909 . . . .	21	14	6	566	50	9	40	1 917
1910 . . . .	7	4	2	276	29	6	23	1 407
1911 . . . .	11	5	2	524	178	29	146	23 530
1912 . . . .	9	5	—	728	99	28	71	12 456
1913 . . . .	10	—	—	835	126	—	—	9 905

(1) 1 quintal = 1.96 cwt.

(2) 1 franc = 9 1/2 d at par.



distinguished in the history of the production of this plant. This results from experiments made on various varieties of beet from 1892 onwards by the Sugar Industry Section (Warsaw branch) of the Society for the encouragement of industry and commerce and continued by the Union of Sugar Refineries of the Kingdom of Poland.

The 1st *period*: from 1880–1898, may be regarded as that of the normal, organic development of the national production of sugar beet in Russia. The number of growers who employ good seed increases yearly and imported seed is slowly replaced by the selected Russian product. For instance, in the Kingdom of Poland, where, in 1892 the amount of seed employed which was produced in the country was 20 %, the proportion of imported seed used being 80 %. In 1897, the proportion of national seed used was 50 %. However, towards the end of the first half of this period (approximately 1894), under the influence of a strong propaganda by interested persons, the opinion gradually gained ground that the Russian seed was superior to the remainder merely on account of the very favourable climatic conditions in South-west Russia where it is produced. The confusion engendered by this propaganda resulted in the disappearance of the distinction previously made between home grown selected and unselected seed. In consequence, twice the amount of seed that was necessary was thrown upon the market. Prices fell so low that the firms seriously concerned with the production of sugar beet seed were no longer able to continue what they had undertaken in this direction.

The 2nd *period*: from 1898 to 1907 is marked by the appearance of foreign firms in Russia, and particularly by that of a big German firm, which, by introducing the reproduction of seeds from sorts selected outside Russia and disposing of a large capital, rendered the position of the few Russian firms still more difficult.

In the production of commercial seed the foreign firms adopted two methods: 1) they made special contracts with the Russian sugar refineries, supplying them with seed which these latter undertook to reproduce themselves according to the methods laid down by the said firms. The refineries then paid according to the crop obtained and at prices previously arranged; 2) they supplied seed to farmers, paying them in advance at a fixed price per quintal subsequently taking the whole of the commercial seed obtained. In this way, during the 2nd period the Russian sugar beet market was completely in the power of and dependent upon foreign firms. The market was filled with various types of native seed and by third rate foreign seed, to the serious detriment of the Russian sugar industry.

The 3rd *period*: from 1908 to 1914 marks the changing round of the

opinion of the public in favour of picked Russian seeds, experiments having shown that these latter are equal in quality to foreign seeds (1).

At the present time the Department of Agriculture, the sugar refineries and in some cases the zemstvos and leading firms as well, are taking measures to increase the production of picked Russian seed in order to satisfy home need and those of exportation also.

At the close of the 3rd period, the purely Russian production of sugar beet seeds rose from 74 000—90 000 quintals, whereas at the beginning of the same period it did not surpass 50 000 quintals. This production represents about 30 % of the total Russian consumption. Native and foreign seeds of beets of generally lower sugar content are responsible for 20 to 25 % and foreign seeds of good quality (though not superior to the best Russian) represent 50 %.

II. — KRIOUKOV insists on the necessity for organising on a large scale, with the aid of the Dept. of Agriculture, the production of prime quality Russian seed. He also advises the starting of trials with sugar beet in Turkestan in order to study the effect of the climate of this region upon the plant, especially with regard to the sugar content.

III. — The results of an enquiry held by the provincial zemstvo of Podolia into the state of plant breeding in this province. Among other matters reference is made to the chief firms interested in the selection of sugar beets.

235. — **Test of the Cultural Value of Vetch Seeds being Residues from Milling, in Hungary.** — See No. 280 of this *Bulletin*.

236. — **The Determination of the Weight of Seeds per Unit Volume: Official Method and Apparatus Adopted in the United States.** — See No. 271 of this *Bulletin*.

(1) With regard to the varieties of sugar beet cultivated in Russia, Prof. D. N. PRIANICHNIKOV, in the 5th edition of his *Text book of Agriculture* (Moscow, 1914), p. 73, says that these are not produced independently but are the result of acclimatisation and selection of western varieties, chiefly those of Vilmorin and of Kleinwanzleben. However, the number of breeding stations has begun to increase in Russia also (according to KUDEKA, 60 at the end of the 19th century in South-east Russia), although recently their situation has become more difficult owing to the increasing demand for foreign seed. The causes of this phenomenon are not altogether clear as the climatic and soil conditions are undoubtedly favourable to the production of beets with high sugar content (it would be somewhat difficult in Russia, to effect an increase of the production), and, further, there are signs that foreign seeds do not germinate so readily or strongly as Russian seeds. The reason for this is that they are evidently less resistant to the disease known as Würzelbrand and to other enemies of the sugar beet. (Ed).

237 - **Improvement of Ghirka Spring Wheat in Yield and Quality.** — CLARK, ALLEN J., in *U. S. Department of Agriculture, Bulletin* No. 450, 19 pp., 7 fig. Washington, D. C., December 4, 1916.

A demand for hardier and more drought-resistant wheats was created with the progress of settlement of the drier portions of the Great Plains area. In response to this demand, the United States Department of Agriculture began about 1898 to improve the wheat crop of that area by the introduction from eastern and southern Russia of varieties which were thought to possess hardness and drought resistance. To determine the value of these varieties they were tested at agricultural experiment stations in different localities in the Great Plains area. The principal economic result of this work was the introduction of Kharkof winter wheat and Kubanka durum wheat (See: CARLETON, M. A. "Hard wheats winning their way" in *U. S. Department of Agriculture, Yearbook* 1914, p. 391-420, fig. 22-25, pl. 35-41. Washington, 1915).

Some of the other varieties obtained were found of value for dryland areas. Among them was the Ghirka Spring wheat, which was both productive and drought resistant, but comparatively low in milling value. Its improvement in yield and quality is the subject of the present paper. The results obtained lead the writer to the following conclusions:

Ghirka Spring wheat has proved adapted to the northern part of the Great Plains area of the United States. The variety is susceptible to rust in moist seasons and in humid areas, but it has proved to be a valuable drought-resistant wheat.

Tests at seven experiment stations in the northern Plains area, covering a period of seven years, have shown that on an average the Ghirka Spring has yielded more than the Rysting Fife and Haynes Bluestem common wheats, but less than the Kubanka durum wheat. The quality of the Ghirka, however, is inferior to that of these standard wheats.

Experiments are being made at the Dickinson (N. Dak.) substation to improve both the yield and the quality of the Ghirka wheat by isolating superior pure lines. Many pure lines have been tested, and among them certain selections have thus far proved superior to the others and to the original mass variety in both yield and quality. They also compare favourably with the standard spring wheats of the Great Plains area in quality as well as in yield. The selections are also proving valuable material for crossing with varieties possessing greater rust resistance and high quality of grain.

From the data given it is shown that improvement in yield and quality is possible from pure-line selection and that good results are being obtained.



- 238 - **Trials of Foreign Varieties of Wheat in Spain.** — I. FIGUEROLA BAL-LESTER, « Araldo del Reno » wheat, in *El Agricultor, Revista mensual de Agricultura*, Year X, No. 11, pp. 121-123. Riotorto, September 1916. — II. DE MAS SOLANES R., High cropping wheats. *Ibid.*, pp. 139-141, October 1916.

I. — Trials carried out at Casarot, Tarragona, in 1915-1916. The seeds were sown at regular intervals on land which had received a complete manuring with artificials. Germination and growth, favoured by the winter rains, were normal; stooling was thick and development very strong. The ears contained 70 to 80 grains, whereas those of local races only bear about 50, on an average; 2 lbs. of seed gave a crop of 105 lbs. Milling and breadmaking results were perfectly satisfactory.

The writer has observed that the grain harvested was not uniform but showed 2 quite distinct types: one with elongated grain and very pronounced longitudinal furrow; the other with round grains and only slightly marked furrow, of a lighter shade of yellow than the first type externally and whiter internally.

II. — The writer confirms the qualities shown by the « Araldo del Reno » variety in most parts of Spain, where it has been under trial for some years: high yield due to the immense size of the ear — resistance to bad weather — good quality flour. Particularly good results have been obtained in the Balearic Archipelago during the last season.

Among other foreign wheats tested by Spanish farmers, the following possess good qualities: « Atlante », particularly suitable for rich soils, and « Tartaria », an early type and easily suited.

Sown at the end of October or in November it ripens at the beginning of July.

- 239 - **The Growth and yield of the Millets *Panicum miliaceum* and *Setaria italica* in Russia and their Relationship with Meteorological Factors.** — See No. 221 of this *Bulletin*.

- 240 - **Growing of Early Season Potatoes from Sprouts** (1). — CADORET, ARTHUR in *Le Progrès agricole et viticole*, 34<sup>th</sup> Year, No. 3, pp. 66-67. Montpellier, Jan 21, 1917.

STARCH CROPS

For the production of early season potatoes, the writer recommends the method of planting by means of sprouts. Tubers are chosen with big eyes and placed in a dark store-room heated to 77°-95° F. When the sprouts are some 6 inches in length a certain amount of light is allowed to enter. In this way the sprouts will acquire a special greenness which will enable them to withstand subsequent transport and manipulation. They are then planted at a depth of 4 inches, 2 or 3 sprouts in each hole, spaced 8 × 20 inches apart.

(1) See also B. 1916, No. 639.

(*Ibid.*).

The results obtained in the granitic soils of the Ardèche are summarised in the appended Table. Trials in the Isère and Loiret in 1916 gave entire satisfaction. The advantages of this method are: considerable economy of seed; a gain of 10 to 15 days in the process of maturation.

*Growing of Early Season Potatoes from Sprouts.*

Year	Length of sprout	Number per hole	Spacing	Yield in lbs per acre
1907 . . . . .	30 cms. (11-8 ins.)	1	50 × 30 cms.	7 135
1908 . . . . .	30 " "	1	60 × 60 "	7 136
" . . . . .	30 " "	2	60 × 60 "	8 028
" . . . . .	30 " "	3	60 × 60 "	8 251
" . . . . .	30 " "	4	60 × 60 "	6 244
1909 . . . . .	10 " (3-9 ins.)	3	30 × 50 "	12 488
" . . . . .	20 " (7-9 ins.)	3	30 × 50 "	15 164

FORAGE CROPS,  
MEADOWS AND  
PASTURES.

- 241 — *Danthonia semiannularis* and *D. pilosa*, Plants Used in Pasture Formation in New Zealand. — COCKAYNE, A. H. in *The Journal of Agriculture*, New Zealand Department of Agriculture, Industries and Commerce, Vol. XIII, No. 5, pp. 352-355, 2 fig., Wellington, November 20, 1916.

The two species of *Danthonia* that are used in pasture formation in New Zealand are *D. semiannularis*, and *D. pilosa*. They are "composite" species, that is to say, They really consist of a large number of strains, and are therefore very variable. Thus, while in some localities the dominant form yields a large amount of herbage, in others, owing to its tussocky development, and the rapidity with which its leaves dry up, the dominant form is of comparatively little use. From this, it will be seen that in seed harvesting it is necessary to gather from areas where the grass has produced a serviceable pasture.

The writer has calculated that the number of seeds per pound averages 550,000 for *D. pilosa* and 900,000 for *D. semiannularis*. The seedling of the former is more vigorous than that of the latter, so that for seeding purposes a pound of *pilosa* can be looked upon as equal to a pound of *semiannularis*.

*D. semiannularis* has the longer leaves, and the plant is more erect and tussocky, not tending towards the production of a close sward. *D. pilosa* forms a comparatively close sward and, when kept short, produces a large amount of fairly succulent herbage.

In the early days of the use of *Danthonia* in New Zealand, *semiannularis* was chiefly grown, but owing to the advice of the Department of

Agriculture, *pilosa* is now generally employed, as it is far the superior form for general purposes. *D. semiannularis* is still used in scrubby "manuka" (*Leptospermum scoparium*) and fern country, where after sowing, burning from time to time is necessary, as it carries a fire so much better than *D. pilosa*.

Much second and third class country in New Zealand originally sown with rye, and cocksfoot (*Dactylis glomerata*), as well as much of the original lowland tussock (*Poa australis*) sheep-country, is now almost pure *Danthonia* pasture. The plant either sowed itself there naturally, or the seed was carried thither in the fleeces of sheep. The development of this type of pasture has been a great advantage. *Danthonia*, however, is not advised for rich land, but only for soils where rye-grass and cocksfoot will not succeed. Another point to be considered is that it is never sown on ploughed land, except under special conditions, such as pumice country, but is practically always sown on the ashes on third class forest land, or on burnt scrub, or fern country.

The best time to sow is from the end of January to the end of March. On poor land, where the best grasses do not hold more than a few years, it is now customary to include from 2 lb. to 6 lb. of *Danthonia* in the mixture. On country originally sown with English grasses, but which has been invaded by fern and "manuka" (*Leptospermum scoparium*) from 12 lb. to 16 lb. of *Danthonia* per acre should be sown mixed with some cheap grass like "Yorkshire fog" (*Holcus lanatus*): but such large amounts are rarely used. Owing to the high price of *Danthonia* seed, less is sown than is advisable. The plant develops fairly slowly, so that it is necessary to mix it with other grasses to cover up the land rapidly. When once established, however, *Danthonia* spreads rapidly, and if kept well down, it forms excellent sheep pasture, but in the autumn it often gets hard, dry and long, and in this case it should be grazed by cattle.

*Danthonia* stands frost well; it is not suitable for hay; it responds very well to top dressing, especially if phosphates are used. Areas should be shut up for seed about the end of October and the seed harvested in January. Good lines should germinate over 80 per cent, but an average germination of 50 per cent can be considered satisfactory. Owing to the fluffiness of the seed, machine-cleaning is out of the question, and the sowing is always done by hand.

242 - **A Sowing Date Experiment With Egyptian Cotton.** — BALLS, LAWRENCE V., AND HOLTON, F. S. in *Philosophical Transactions of the Royal Society of London*, Series B., Vol. 206, pp. 403-480. London 1915.

FIBRE CROPS

Experiment made at Giza in 1913, for the purpose of determining the effect of the sowing-date upon the chief stages of plant development which influence yield. Nine sowings were made on the following dates: February



15 and 22; March 1, 8, 15, 22, 29; April 5 and 12. The bolls were gathered 3 times; on September 10, October 1 and November 5.

The data of the harvest are given in Table I and show the following facts: 1) To delay sowing until after March 15 has always a bad effect upon the quality, as well as the quantity, of the crops; 2) on the other hand, if the sowing is done before that date, no special advantage is gained, and in some cases harm results.

This last statement is contrary to the general opinion of agricultural experts in Egypt which tends rather to planting early, but it proves the wisdom of the fellaheen cultivators, who in the Giza district sow their rice between March 10 and 15.

Data of sowing		Number of bolls gathered from each plant at the			Total	Date of ripening of the first 5 bolls
		1st picking	2nd picking	3rd picking		
Feb.	15. . . . .	6.17	4.87	3.72	14.75	Sept. 2
"	22. . . . .	7.32	5.97	3.14	16.43	Aug. 30
March	1. . . . .	6.82	4.53	3.39	14.72	" 31
"	8. . . . .	7.36	4.89	3.11	15.35	" 30
"	15. . . . .	6.85	5.93	3.21	16.00	" 31
"	22. . . . .	5.70	5.46	3.69	14.88	Sept. 3
"	29. . . . .	4.85	5.00	3.38	13.20	" 9
April	5. . . . .	3.07	5.18	4.12	12.39	" 13
"	12. . . . .	2.38	4.39	4.05	10.80	" 18

The optimum sowing date in the Giza district is thus March 15. Early sowing is not favourable to flowering or bolting and often occasions uneven germination.

The writer is of opinion that these facts are due to insufficient absorption of water on the part of the plant and probably to the production of toxins which accumulate in the growing cells and hinder the development of the various organs. Since, in order to obtain normal development in the cotton plant, it is necessary to sow practically at a constant date which cannot be anticipated, the question arises as to the factor which has a depressant effect upon the early seedlings.

The temperature of the soil is the only factor whose seasonal variations are practically uniform from year to year. We should note that the development of the lateral roots does not take place until the tap-root is some 15 cm. long, and that the time at which this length is attained is longer the cooler the temperature of the soil. Until the lateral roots begin to form, water is absorbed with difficulty and the above-mentioned toxins are produced.

Moreover, independently of the absorbant surface, which increases with the growth of the lateral roots, the amount of water absorbed increases with the rising temperature. Absorption in the roots of the cotton plant is negligible below 10° C. Towards the middle of March, the temperature conditions are such that:

1) In the same number of days, the later-sown plants develop a larger root system than the earlier-sown plants.

2) The root system is absorbing water more rapidly.

Further north than Giza, the soil temperatures are lower; the optimum sowing date should therefore probably be later than March 15. This conclusion is supported by the data furnished by H. H. Prince Omar Pasha Toussouin. The converse should obtain further south.

The optimum sowing date not only depends upon latitude and altitude, but also upon the soil. It might differ in two adjoining fields, if the surface soil of one were sandy and in the other of heavier texture, since these would change their temperature at somewhat different rates.

243 - **Cotton Growing Prospects in the French Colonies, Results in Algeria.** —

*Comptes Rendus des Séances de l'Académie d'Agriculture de France*, Vol II, N° 36, pp. 1031-1038; N° 41, pp. 1207-1210. Paris, Nov. 22 and Dec. 27, 1916.

France imports every year 400 million francs worth of cotton from the United States, India and Egypt; her cotton industry employs 300 000 workers. The whole of the raw material could be produced in the French colonies, either on 5 900 000 acres of unirrigated land or on 2 965 000 acres of irrigated land.

The problem of cotton cultivation is now being studied in Morocco, the Sudan, Senegal, Dahomey. In the last-named country a variety of cotton plant has been discovered, not native, but one which has become adapted to the country. The fibre produced is neither long nor silky but belongs to the "woolly" type of cottons and so may be worked in company with wool for certain mixed tissues. The valleys of the Senegal and Niger offer immense stretches of territory where cotton might be cultivated provided the necessary irrigation work was carried out.

During the American War of Independence, the department of Oran (Algeria) was a large producer of cotton, but its cultivation was subsequently totally abandoned. Since 1904 attempts have been made to restart it.

The Colonial Cotton Growing Association has been carrying on propaganda work in this same department, by distributing seed, building ginning factories at Oran and providing facilities for the sale of the crop.

M. F. GODARD has begun an experimental cotton plantation at the Philippeville School of Agriculture and has obtained most encouraging results. It has been shown that, contrary to the general opinion, cultivation

on unirrigated land is possible over large areas in Algeria. In 1906, trials were made by various agriculturists along the Algerian and Tunisian littoral. In 1908, three cooperative ginning societies were founded at Philippeville, Bône and Orléansville. Wherever cultivation has been carried out under normal conditions, results have been profitable. It is now admitted, that medium staple (Mit-Affi) and short staple (Mississippi type) cottons from Algeria spin very satisfactorily.

The Governor General of Algeria is taking an interest in cotton growing in the colony and has begun selection work with the object of producing improved seed.

244 - **Rubber Investigation at the Central Rubber Station.** — VRIES O. DE in *Mededeelingen van het Centraal Rubberstation*, No. 1. Batavia 1916.

In the first part of the present paper the writer deals with the methods in use for rubber testing at the Central Rubber Station at Buitenzorg.

By means of the curves drawn on the Schopper machine the rubber is judged in regard to:

- 1) the type of the curve;
- 2) the time of cure, necessary to bring the rubber to the right state of cure, i.e. the curve to the right position;
- 3) tensile strength, load at breaking in kg. per sq. mm;
- 4) length at breaking, final length in % of original;
- 5) length at a certain load, for which 1.30 kg per sq. mm is generally chosen. This is very convenient for expressing the relative position of the stress-strain-curves and for judging of the uniformity in rate of cure.

The results are given and graphically demonstrated in tables, obtained from one homogeneous lot of rubber vulcanised a number of times; in fact it was used as a control-sample for every separate vulcanisation. The big number of testings so obtained enable the position of the stress-strain-curve and breaking point to be fixed with great accuracy.

The results are discussed of the combined sulphur insoluble in acetone, calculated on the total vulcanised mixture. The points lie in a straight line; this agrees with the more elaborate investigations of SPENCE YOUNG (*Kolloid Zeitschrift* 11,28 and) GOTTLOB (*Gummi Zeitung* 30, 303).

Chapter II gives an illustration of the work which the Central Rubber Station is doing for estates. Lack of uniformity still seems to be the chief fault of plantation rubber. On the other, hand the testing of estate-samples is not of the least value as long as it is not known in how far a sample from one day or from one case has, practically speaking, the same qualities as samples from other days or from other cases of the same grade. Before starting work of this kind it is therefore necessary to get an insight into the degree of uniformity of the product now shipped by the contributing estates.



The results obtained from an estate on which the rubber is very uniform are shown, notably in rate of cure, the samples having all been cured for 2 hours with  $7\frac{1}{2}\%$  S (calculated on the mixture) at  $148^{\circ}$  C.

The results of another estate show a different aspect; the samples, in this case all cured for  $2\frac{1}{4}$  hours with  $10\%$  S at  $140^{\circ}$ , are far from uniform, and the estate in question is now changing its methods of preparation in order to reach the desired degree of uniformity in product.

Chapter III gives some preliminary observations on the influence of temperature and sulphur-content on the vulcanisation.

Some data obtained at  $148^{\circ}$  are compared with those after vulcanisation during double the time at  $140^{\circ}$ . The curves in nearly all cases coincide approximately, so that one may conclude that the rate of cure at  $148^{\circ}$  is double that at  $140^{\circ}$ . This agrees with the results of SPENCE, (*Kolloid Zeitschrift* 11, 28) who found the temperature-coefficient in these regions to be 2.67. For a comparison of testing results at different laboratories one has also to take into account the time used for heating till the temperature of vulcanisation is reached, and later for cooling till a temperature at which the vulcanisation practically stops, so that in practice results obtained at  $148^{\circ}$  do not always show double the time of cure of results at  $140^{\circ}$ .

The results are discussed obtained by curing mixtures with different percentages of sulphur; the curve lies lower with increasing sulphur-content, indicating that the vulcanisation proceeds more rapidly as the amount of sulphur present increases.

Other figures show the tensile strength and the length at breaking of some of these mixtures after different cures. With  $7\frac{1}{2}\%$  and  $10\frac{1}{2}\%$  sulphur a definite maximum in tensile strength is reached, whilst with  $5\%$  sulphur even after  $4\frac{1}{2}$  hours cure the tensile strength still increases. This shows that for testing purposes the percentage of sulphur in the mixture must be taken higher than  $5\%$ . Similar results were some time ago published by GOTTLOB for mixtures of Para rubber, sulphur and vulcacite as an accelerator (*Gummi Zeitung* 30, 326).

The product load length at breaking point for different percentages of sulphur has been investigated by the writer.

A comparison is made between the time of cure for mixtures with  $7\frac{1}{2}\%$  and  $10\%$  sulphur. To bring the curve into the same position a mixture with  $7\frac{1}{2}\%$  sulphur must be cured approximately  $1\frac{1}{2}$  times as long as a mixture with  $10\%$ .

- 245 - **The Rubber Industry in Malaya.** — *Gouvernement Général de l'Indo-Chine, Bulletin Economique de l'Indo-Chine*, Year 19, No. 17, p. 121. Hanoi-Haiphong, January-February 1916.

The phenomenal increase in rubber-growing in Malaya is shown by the figures for the last 10 years:

Year	Amount	Price per lb.	Total value in £
1906. . . . .	430 Tons.	5 shillings	£ 240 800
1907. . . . .	885	4 $\frac{1}{2}$	» 446 040
1908. . . . .	1 629	4	» 729 892
1909. . . . .	3 340	7	» 2 618 560
1910. . . . .	6 504	6	» 4 370 688
1911. . . . .	11 500	4	» 5 172 000
1912. . . . .	21 305	4	» 9 548 900
1913. . . . .	35 352	3	» 11 872 000
1914. . . . .	50 404	2 $\frac{1}{4}$	» 12 700 000
1915. . . . .	68 500	2 $\frac{1}{2}$	» 19 180 000

Thus the Malay States, whose great wealth up to the present has been tin, with an export worth on the average £ 7 613 000, have now in their rubber plantations a much more important source of wealth, since the value of the production in 1915 is worth over 19 million pounds sterling.

- 246 - **Observations in Java on the Mould attacking Sheet Rubber.** — ARENS P., in *Mededeelingen van het Proefstation Malang*, N<sup>o</sup> 13, pp. 3-9, Soerabaja, 1911.

The writer has studied cases where sheet rubber, after having been packed for occasionally quite a short time, has become covered with mould due to a growth of Ascomycetes (*Penicillium*, *Aspergillus*, etc.).

It is important that all utensils used in the coagulation and transport of latex should be kept thoroughly clean.

The same applies to the racks in the drying sheds from which the sheets are suspended.

The sheets should be quite dry before being packed and only thoroughly dry wood should be used for making packing cases. Sheets attacked by mould may be disinfected with a 3% solution of chinisol.

- 247 - **The Effect of Cultural and Climatic Conditions on the Yield and Quality of Peppermint Oil.** — RABAK FRANK, in *U. S. Department of Agriculture Bulletin* No. 454, 16 pp. Washington, December 9, 1916.

The value of the peppermint (*Mentha piperita*) oil depends much on its composition. The principal ester constituent, menthyl acetate, possesses a very fragrant minty odor, to which the agreeable aroma of the oil is largely due. The alcoholic constituent, menthol, possesses the penetrating

minty odour and characteristic cooling taste. The flavoring properties of the oil are due largely to both the ester and alcoholic constituents, while the medicinal value is attributed to the latter only. The elaboration of these constituents depends upon the various cultural climatic conditions to which the plant is subjected during growth.

In order to obtain data bearing on possible variations in the composition of peppermint oil under varying conditions, the following points were studied by the writer, of the Drug-Plant and Poisonous-Plant Investigations Division of the Bureau of Plant Industry of the U. S. Department of Agriculture: Effect of soil and climate on the composition of peppermint oil; yield of oil from fresh and from dry plants at various stages of growth; physical and chemical properties of peppermint oil from fresh and from dry plants at various stages of growth; effect of light and shade; effect of frost action.

From the results obtained the following conclusions are drawn:

Conditions of soil and climate are influential factors in the formation of oil and its constituents in the peppermint plant. Light sandy or loamy soils appear to be most favorable for the production of an oil of high quality.

The yield of oil distilled from fresh plants apparently decreases as the plant matures (See Table I). Drying the plant before distillation results

TABLE I. — *Yield of peppermint oil from the fresh and from the dry herb at various dates of distillation and stages of growth during five successive years (1908-1912).*

		Average Per cent *
Fresh herb. . . . .	budding. . . . .	0.134
	flowering . . . . .	0.132
	fruiting. . . . .	0.114
Dry herb . . . . .	budding. . . . .	0.066
	flowering . . . . .	0.050
	fruiting. . . . .	0.046

\* Calculated on the basis of fresh herb.

in a considerable loss of oil. The largest proportion of oil is found in the leaves and flowering tops (See Table II).

The percentage of esters in the oils increases as the plants approach maturity. The content of menthyl acetate of the oils varied in the budding plant during the several seasons 1908-1911 from 6.72 to 16.67 per cent,



TABLE II. — *Comparison of yields of peppermint oil from the fresh leaves, from the tops, and from the whole fresh herb at different stages of growth during three successive years.*

		Average Per cent *
Whole herb . . . . .	budding. . . . .	0.116
	flowering . . . . .	0.113
	fruiting . . . . .	0.133
Leaves . . . . .	budding. . . . .	0.203
	flowering . . . . .	0.303
	fruiting . . . . .	0.120
Tops . . . . .	budding. . . . .	0.173
	flowering . . . . .	0.233
	fruiting . . . . .	0.153

\* Calculated on the basis of fresh herb.

in the flowering plant from 7.07 to 14.5 per cent, and in the fruiting plant from 12.37 to 20.86 per cent.

The menthol content of the oil bears a close relationship to the ester content.

In many cases when the ester content is high the free menthol content is low, and vice versa. This relationship is but natural, as the higher the percentage of menthol in combination in ester form the lower is the percentage of free menthol. The oils with the highest content of total menthol are those which contain the highest content of free menthol and also combined menthol, or ester.

The free acidity and ester content of the oil distilled from dry plants is considerably higher than in the oil from fresh plants. The drying of the plants causes changes favorable to esterification, while the percentage of free and total menthol in oils distilled from dried plants in also uniformly high.

The formation of esters and menthol takes place most readily in the leaves and tops of the plant, the metabolic processes showing increased activity as the plant matures.

The effect of shade upon the peppermint plant is to decrease esterification and the formation of menthol, and is due possibly to the lessened activity of the alimentation of water by the plant.

The action of frost noticeably increases esterification and the formation of menthol.

- 248 - **Trials on the Cultivation of the Opium Poppy by the Bezentchouk Agronomic Station in the Province of Samara, Russia.** — KOULTCHIZKIJ JA. P., in Земледельческая Газета (*The Agricultural Gazette*), No. 37, (152), pp. 975-976. Pietrogrado, 1916.

The Bezentchouk Agricultural Experiment Station has been engaged, since the spring of 1916, on experimental work in the cultivation of medicinal plants. The results obtained with the opium poppy have just been published.

The white and blue *Papaver somniferum* was sown on April 19 in lines 35 cms apart on 3 plots measuring 81, 45 and 36 square meters respectively; the first seedlings appeared on April 28, and on May 18 the plants were thinned, a space of 10-16 cms being left between each. Flowering began on June 2; the tapping of the capsules was begun on July 5 and terminated on the 23<sup>rd</sup> of the same month. At the time the tapping of the capsules was begun the average height of the plants was 130 cms and there were about 4 capsules per plant.

For making the incisions a very simple form of knife was devised. Two "Gillette" razor blades were fixed to a flat strip of wood 4 mms apart so as to project 2 or 4 mms. Both longitudinal and transversal incisions were made, the latter giving the better results.

The work of tapping was begun towards 4 o'clock in the evening and the solid exudate collected the following morning in small glass tubes. The latex was then weighed and forwarded to the laboratory for extraction of the morphine. In all, there was collected: from the 1<sup>st</sup> plot 45.5 gr — from the 2<sup>nd</sup> 39.9 gr — from the 3<sup>rd</sup> 35 gr of crude opium, containing 28 % of water and 12 to 18 % of morphine. Calculating the average morphine content at 15 %, the amount of dry opium obtained would be 6 kg of dry opium per hectare (5.35 lbs. per acre) and about 90 gr of morphine.

Although these trials were only of a tentative character, they have sufficed to show that the cultivation of the opium poppy is possible in the Province of Samara, and they have also demonstrated the quantity of morphine obtainable. Whether or not this province is best adapted from the economical point of view can best be settled when the data from similar trials in other parts of the Russian Empire are available.

- 249 - **Culture and Forcing of Witloof Chicory.** — WELLINGTON J. W., in *New-York Agricultural Experiment Station, Geneva, N. Y., Bulletin* No. 418, pp. 89-98 + 3 plates. Geneva, March 1916.

HORTICULTURE

Witloof chicory, an improved variety of the common chicory *Cichorium intybus* Linn., is little grown in America as a salad plant, but of wide and extended use throughout Europe. Its culture has attained great importance and perfection in Belgium and France, from whence

large quantities were imported to America previous to the war. In the belief that this vegetable can be grown and forced profitably by American gardeners, the New York Agricultural Experiment Station, Geneva, N. Y., is conducting investigations relative to its production.

It has been found that plants may be easily grown from seed in the Geneva environment.

Roots having a crown diameter within the limits of one to two inches produced the greater number of marketable heads.

Sand proved to be a very satisfactory medium with which to cover the forcing roots, in that it is easily obtainable, blanches the leaves perfectly and promotes the formation of compact heads.

Temperatures averaging 56° and 61° F. were found satisfactory in producing a marketable crop. It is evident that a range of 50° to 60° F. is approximately the optimum.

The size of head was in accordance with the size of root used, as may be seen from the following table.

*Relation of Forced Heads of Witloof Chicory to Roots,  
in Weight and Quality.*

Size	Number	Total Weight of heads	Average Weight of heads	Percentage of marketable heads
Extra . . . . .	22	7 lbs 2 ozs	5.18 ozs	50
Large . . . . .	54	11 8	3.40	72
Medium . . . . .	52	5 1	1.56	73
Small . . . . .	44	2 9	0.93	41

The length of time required for forcing the crop was 15 days, showing that several crops might be grown in the same soil during a winter season.

The harvest produced at the Station was acceptable in quality and appearance and much superior to the foreign product in flavor and in freshness.

250 - *Martynia proboscidea*, a Vegetable which Should be more Extensively Grown in the United States. — ROSA J. T. JR. in *The Country Gentleman*, Vol. LXXXI, No. 53, p. 2231. Philadelphia, December 30, 1916.

*Martynia proboscidea*, which is commonly known in the United States as "devils' claw", or "pickle with a nose", is a native of the arid



southwest, but it makes a luxuriant growth in the moister and cooler parts of the country; it is very susceptible to frost.

The pods are round, 5 to 8 inches long and are covered with short, soft down: they should be picked for use either as pickles, or for green vegetables, while they are small and green, for upon maturity they become tough, turn brown, split open and discharge the ripe seed. The plants grow very fast, and a few seeds sown in hills three feet apart in the open, after all danger of frost is over, will produce pods in less than 6 weeks, and continue to fruit until frost cuts down the plants in the autumn. During this long season an immense quantity of fruit is produced.

In the middle Western States, large quantities of *Martynia proboscidea* are grown for pickling. The pods are worthy of more extensive use as a green vegetable, and the plant itself is ornamental.

251 - **New Experiments in Pruning Apple Trees in Oregon, United States.** — GARDNER V. R., MAGNESS J. R. AND YEAGER A. F., in *Oregon Agricultural College Experiment Station, Division of Horticulture Bulletin* 139, pp. 1-88 + XXII Plates Corvallis, Oregon August, 1916.

FRUIT  
GROWING

I. *Early Summer Pruning of Young Apple Trees.* — Experiments carried out in 1912 at the Oregon Experiment Station on 313 trees, the varieties being Wagener, Yellow Newtown, Jonathan and Grimes. The records of growth under the varying pruning treatments include number and length of shoots, shoot diameter, trunk circumference, number and distribution of fruit spurs.

The data relating to shoot growth indicate that, on the average, the unpruned tree increases in size a little more rapidly than the tree that is winter-pruned only, or that is both winter and summer pruned. The difference in growth is, however, very small. The summer-pruned trees lose more shoot growth from pruning, but they produce nearly enough to compensate for the additional loss. The amount of shoot growth produced any one season by young apple trees that have not yet developed many spurs, is closely correlated with the amount they made the preceding season and shows little correlation with the severity of their winter pruning.

In the same way, the amount of shoot growth shows little correlation with the severity of the summer pruning. There seems to be a close correlation between increase in trunk circumference at any period during the summer, and the leaf area possessed by the tree at that particular time.

In some varieties, heavy early summer pruning has the effect of causing those shoots remaining after the pruning to thicken and become more stocky. In other varieties, the shoots in the trees that are winter pruned only are the thicker and stockier. In all the varieties studied, the late shoot growth formed after the summer pruning is comparatively slender.

The summer pruning practised in these experiments affords a direct stimulus to spur formation. Some of the buds on the basal portions of the shoots that are left after the summer pruning almost invariably grow into fruit spurs during the latter part of the summer. Those that remain dormant during the latter part of the summer, are just as apt to develop into spurs the following year, as similarly situated buds on shoots that are not summer pruned.

The late summer shoot growth of the summer pruned trees is very productive of fruit spurs the season following its formation. A high percentage of its buds develop into spurs. Herein, apparently, lies the chief gain in fruit-spur production from the summer pruning. On the trees that are winter pruned only, there is no growth to correspond to it. There is little or no relation between the severity of the summer pruning, and the number of spurs to each unit of shoot length that remains.

Summer pruning of the type described, affords a means of developing a fruit spur system in young apple trees earlier than is possible with the ordinary method of winter pruning only. It is estimated that its judicious use with varieties bearing mainly upon spurs, will enable the apple grower to bring his trees into bearing approximately a year earlier, and still maintain and develop a good framework.

Summer pruned trees show a tendency to mature their wood a little later in the autumn; they have not, however, proved more susceptible to bark splitting caused by severe winter weather.

II. *The Influence of Summer Pruning on the Bud development in the Apple.* — A study of the influence of summer pruning upon apple bud development under Western Oregon conditions, warrants the following statements:

The method and season of spur fruit bud differentiation and development was found to be identical with that described by previous investigators. Spur leaf buds developed during early summer, but little occurred later than July in those varieties investigated. Axillary buds developed very rapidly for a time following their initial formation, then grew slowly until about the time shoot growth ceased.

Initial development of axillary fruit buds occurred about one month later than in spur buds on the same trees. The main differentiation took place during late August and September. The method of development of axillary fruit buds seemed to be exactly like that of spur fruit buds. However, they followed spur buds in point of time of differentiation, and never entirely caught up with them.

The difference between axillary buds in general and buds on spurs, in general, seemed to be in degree of development, rather than in method. The influence of the early summer heading back could be detected in the number of fruit buds formed on established spurs.

Early summer heading back tended greatly to reduce the number of fruit buds formed on one year wood.

Leaf buds on pruned shoots, both on the primary and secondary growth, were not visibly influenced by the pruning. They appeared to function like similarly located buds on unpruned shoots.

This, coupled with the fact that the form of the summer pruned shoot, which allows many axillary buds to be left at the time of the following winter pruning, accounts for the greatly increased number of spurs in trees that have received regularly an early summer heading back.

### III. *A Statistical Study of the Fruit-Spur System of Certain Apple Trees.*

— This statistical study was made on 2000 fruit spurs of "Grimes, Yellow Bellflower" and "Domine". As a general rule, the percentage of spurs which flowered decreased more or less rapidly with age, depending on the variety. The percentage of spurs bearing fruits decreased much more rapidly than the percentage blooming. On the average, spurs decreased in amount of fruit to each bearing spur as they became older, though the more vigorous of the older spurs produced more than the average of the younger spurs. Among spurs of uniform age, there was a marked degree of correlation between their length and production. This correlation was more pronounced as the spurs became older. There was considerable correlation between the amount of growth that a spur made one year and its production the following year. The average "Grimes" spur grew more during the year that it produced fruit, than the year it was not fruiting. Spurs bearing 2 years in succession averaged somewhat less to each spur the second season, than other spurs that bore no crop the first season.

There was a high degree of correlation between the diameter of spurs and their production. This was practically the same for old spurs as for young.

Spurs of the same age borne on branches of large diameter bore a larger amount of fruit than those on smaller branches.

In the "Grimes" tree studied, the largest average production for each spur was found in the south quarter. The upper part of the tree produced more to each spur than the lower, and there was a slightly greater production for each spur on the outside of the tree than on the inside. Wherever the average production for each spur was less than the mean, the average age was more.

252 - **Good Hybrld Direct Bearers Cultivated in France** (1). — PEE-LABY E., in *Revue de Viticulture*, 23<sup>rd</sup> Year, Vol. XLV, No. 1173, pp. 405-409. Paris, December 21, 1916.

VINE GROWING

The accompanying list of direct bearers contains numbers the chief characters of which are great fertility and regularity in bearing. They

(1) See also B. 1916, No. 185.

(Ed.)



have already given proof of their capacity in these respects, having been in cultivation for the last fifteen years at least. The writer, by whom they are recommended, is chief lecturer at the University of Toulouse.

*Hybrids with black grapes:* Seibel No. 1020 — Seibel No. 1077 — Seibel No. 1000 — Seibel No. 1070 — Seibel No. 2003 — Seibel No. 138 — Seibel No. 4121 — Seibel No. 2859 (rose hybrid) — Malegue No. 829-6 (does well in the moist regions of South-west France).

*Hybrids with white grapes:* Seibel No. 793 — Seibel No. 880 — Seibel No. 2653 — Seibel No. 3021 — Seibel No. 4681 — Gaillard-Girard No. 157.

253 — **The Chemical Composition of American Grapes Grown in the Central and Eastern States.** — ALWOOD WILLIAM B., in *United States Department of Agriculture, Bulletin* No. 492, 20 pp. Washington, D. C. December 18, 1916.

This report is supplementary to the writer's account of the American grapes grown in the States of Ohio, New York and Virginia: Alwood William, B., *Enological Studies*, No. 4: *The Chemical Composition of American Grapes Grown in Ohio, New York and Virginia in U. S. Department of Agriculture, Bureau of Chemistry, Bulletin*, 145. Washington, 1911.

The results of the analyses are given in 2 tables. The data are arranged by localities, and the average, maximum and minimum results are given when more than one sample was taken for each locality; a total average of all the analyses of each variety is given, with maximum and minimum results as to solids, sugar and acid on all the samples of any given variety examined. The specific gravity determined by a pycnometer at 15-6° C is given individually for all single samples and the average is given where two or more samples are recorded for any locality. There were 171 analyses made. In table 3 are set forth the results for sugar and acid determinations of all the varieties, with a few exceptions, examined from 1908 to 1911 and in 1913. A summary of these data is given in the following table, where the maximum and minimum results are recorded for the same variety in the different States of North America.

*Composition of American Grapes.*

Variety	Sugar as invertase gr. in 100 cc. of juice	Acid as tartaric gr. in 100 cc. of juice	Acid-sugar ratio
Adirondac . . . . .	10.19	0.911	1 : 11.2
Agawam. . . . .	15.28 a 19.02	0.840 a 1.344	1 : 11.4 a 1 : 22.3
Amber Queen . . . . .	16.62	1.436	1 : 11.2
America . . . . .	16.94	1.436	1 : 11.8
Aminia . . . . .	16.68	0.821	1 : 20.3
Bacchus . . . . .	17.42 a 20.51	1.205 a 1.852	1 : 9.8 a 1 : 17.0
Barry . . . . .	12.12	1.159	1 : 10.5
Belle . . . . .	18.78	1.114	1 : 16.9
Big Extra . . . . .	13.91	1.466	1 : 9.5
Black Eagle . . . . .	17.57	1.011	1 : 17.4
Brighton. . . . .	17.67 a 20.47	0.632 a 0.822	1 : 21.2 a 1 : 32.4
Brilliant . . . . .	18.71	0.676	1 : 27.7
Brown . . . . .	13.64	1.106	1 : 12.3
Butler N <sup>o</sup> 1 . . . . .	17.03	0.833	1 : 20.4
Campbell Early. . . . .	13.61 a 15.56	0.540 a 0.884	1 : 17.4 a 1 : 27.6
Canada . . . . .	14.60	1.028	1 : 14.2
Carman . . . . .	13.29	1.654	1 : 8.0
Catawba. . . . .	16.22 a 20.78	0.709 a 1.552	1 : 10.4 a 1 : 28.6
Champion . . . . .	11.90	0.915	1 : 13.0
Chatauqua . . . . .	13.50	1.043	1 : 12.9
Clevener. . . . .	13.68 a 14.96	1.196 a 2.285	1 : 10.6 a 1 : 12.5
Clinton . . . . .	17.73 a 21.62	1.081 a 2.130	1 : 8.9 a 1 : 18.4
Cloete . . . . .	16.02	1.088	1 : 14.7
Colerain. . . . .	12.76	0.870	1 : 14.7
Concord. . . . .	14.08 a 18.51	0.466 a 0.888	1 : 18.5 a 1 : 37.3
Conqueror . . . . .	12.98	1.074	1 : 12.1
Corby. . . . .	13.77	0.938	1 : 14.7
Creveling . . . . .	13.93	1.009	1 : 13.8
Croton . . . . .	11.84	0.788	1 : 15.0
Cynthiana . . . . .	19.10 a 21.23	0.767 a 1.598	1 : 12.0 a 1 : 27.7
Daisy . . . . .	16.95	0.653	1 : 26.0
Delago . . . . .	17.25	1.009	1 : 17.1
Delaware . . . . .	18.06 a 25.80	0.467 a 1.809	1 : 19.7 a 1 : 54.1
Diamond . . . . .	16.52 a 17.48	0.634 a 1.058	1 : 15.6 a 1 : 24.4
Diana. . . . .	18.80 a 20.27	0.950 a 0.986	1 : 19.1 a 1 : 21.0
Diogenes . . . . .	14.23	1.599	1 : 8.9
Dutchess. . . . .	16.78 a 18.02	0.586 a 0.734	1 : 23. a 1 : 28.6
Early Dawn . . . . .	16.22	1.065	1 : 15.2
Early Golden. . . . .	18.50	0.848	1 : 21.8
Eldorado . . . . .	19.63	0.784	1 : 25.0

*Composition of American Grapes.*

Variety	Sugar as invertase gr. in 100 cc. of juice	Acid as tartaric gr. in 100 cc. of juice	Acid-sugar ratio
Elvira . . . . .	13.57 a 17.16	0.735 a 1.288	1 : 11.0 a 1 : 20.9
Empire State . . . . .	16.10	0.704	1 : 22.9
Etta . . . . .	11.24	1.369	1 : 8.2
Eumelan . . . . .	13.54 a 18.38	0.706 a 0.961	1 : 14.6 a 1 : 26.0
Franken Riesling . . . . .	18.15	1.208	1 : 15.0
Franklin . . . . .	18.41	1.188	1 : 15.5
Goethe . . . . .	15.12	0.888	1 : 17.0
Goff . . . . .	15.64	0.895	1 : 17.5
Gold Dust . . . . .	15.71	0.694	1 : 22.6
Golden . . . . .	17.04	0.420	1 : 40.6
Glenfeld . . . . .	14.56	1.106	1 : 13.2
Green Early . . . . .	14.21	0.758	1 : 18.8
Gutedel . . . . .	20.20 a 20.36	1.144 a 1.350	1 : 15.1 a 1 : 17.7
Hayes . . . . .	15.16 a 18.45	0.893 a 1.118	1 : 13.6 a 1 : 20.7
Hartford . . . . .	15.81	0.893	1 : 17.7
Herbert . . . . .	16.54	1.200	1 : 13.8
Herbemont . . . . .	15.55	0.904	1 : 17.2
Hexamer . . . . .	16.36	1.245	1 : 13.1
Hicks . . . . .	13.32	1.159	1 : 11.5
Honey Dew . . . . .	16.34	0.956	1 : 17.1
Illinois City . . . . .	17.81	0.998	1 : 17.8
Iona . . . . .	18.87 a 21.31	0.679 a 1.238	1 : 15.2 a 1 : 31.1
Isabella . . . . .	13.91 a 16.97	0.645 a 1.228	1 : 13.8 a 1 : 26.3
Ires . . . . .	11.80 a 16.84	0.519 a 0.917	1 : 15.0 a 1 : 31.1
Janesville . . . . .	13.95	1.462	1 : 9.6
Jefferson . . . . .	17.45	0.886	1 : 19.7
Jessica . . . . .	19.70	0.450	1 : 45.8
Lenoir . . . . .	14.90	1.546	1 : 9.6
Lindley . . . . .	15.61 a 18.54	0.704 a 1.054	1 : 14.8 a 1 : 25.8
Lucile . . . . .	14.46	0.865	1 : 16.7
Marion . . . . .	17.31 a 20.77	1.566 a 1.718	1 : 11.1 a 1 : 12.1
Martha . . . . .	16.07	0.840	1 : 19.1
Massasoit . . . . .	15.21	0.754	1 : 20.2
Matfield . . . . .	15.87	0.796	1 : 19.9
Millo . . . . .	19.85	0.741	1 : 26.9
Missouri Riesling . . . . .	14.30 a 19.13	0.656 a 0.941	1 : 16.8 a 1 : 28.3
Molitor . . . . .	20.36	1.006	1 : 20.2
Montefiore . . . . .	17.32 a 14.80	0.401 a 0.842	1 : 23.7 a 1 : 61.8
Moore Diamond . . . . .	17.48	0.634	1 : 24.4
Moore Early . . . . .	9.04	0.825	1 : 11.0



*Composition of American Grapes.*

Variety	Sugar as invertase gr. in 100 cc. of juice	Acid as tartaric gr. in 100 cc. of juice	Acid-sugar ratio
Moyer . . . . .	17.61	0.711	1 : 24.8
Munson . . . . .	13.57	1.490	1 : 9.1
Nectar . . . . .	17.26	1.256	1 : 13.7
Niagara . . . . .	13.14 a 18.92	0.448 a 0.822	1 : 16.2 a 1 : 42.2
Noah . . . . .	14.25 a 20.25	0.750 a 1.632	1 : 8.7 a 1 : 27.0
Norton . . . . .	17.67 a 25.27	0.867 a 2.212	1 : 9.1 a 1 : 25.1
Norfolk . . . . .	16.10	1.144	1 : 14.1
Olita . . . . .	15.97	0.908	1 : 17.6
Pierce . . . . .	12.42	1.253	1 : 9.9
Pocklington . . . . .	16.85 a 17.04	0.700 a 0.846	1 : 20.1 a 1 : 24.1
Prentiss . . . . .	17.47	0.728	1 : 24.0
Regal . . . . .	16.11	0.836	1 : 19.3
Regna . . . . .	16.75	0.844	1 : 19.8
Roger . . . . .	18.10	1.035	1 : 17.5
Rogers N° 24 . . . . .	13.19	1.238	1 : 10.7
Rogers N° 32 . . . . .	15.43	1.181	1 : 13.1
Rupert . . . . .	13.28	1.756	1 : 7.6
St Louis . . . . .	13.31	1.140	1 : 11.7
Salem . . . . .	17.41 a 20.17	0.510 a 1.085	1 : 16.0 a 1 : 34.5
Schraidt . . . . .	17.50 a 18.85	1.294 a 1.823	1 : 9.6 a 1 : 14.1
Seibel . . . . .	11.10	1.852	1 : 6.0
Taylor . . . . .	17.57	1.326	1 : 13.3
Telegraph . . . . .	13.90	1.256	1 : 11.1
Tragedy . . . . .	16.65	0.776	1 : 21.5
Triumph . . . . .	11.09 a 14.09	1.012 a 1.354	1 : 10.4 a 1 : 11.0
Ulster . . . . .	19.23	0.684	1 : 28.1
Vergennes . . . . .	17.34	1.082	1 : 16.0
Wapanuka . . . . .	9.42	1.084	1 : 8.7
Wilder . . . . .	14.11 a 14.44	1.020 a 1.189	1 : 11.9 a 1 : 14.2
Winchell . . . . .	19.28	0.506	1 : 30.1
Woodruff . . . . .	13.54 a 14.34	0.409 a 0.660	1 : 20.5 a 1 : 35.1
Worden . . . . .	13.12 a 17.24	0.709 a 0.998	1 : 14.2 a 1 : 24.3
Wyoming Red . . . . .	13.29	0.805	1 : 16.5

## LIVE STOCK AND BREEDING.

HYGIENE OF  
LIVESTOCK.

- 254 - **Observations on Some Insect Pests of Livestock in the Belgian Congo.** — ROUBAND, E. and VAN SAGEGHEM, R., in *Bulletin de la Société de Pathologie Exotique*, Vol. IX, No. 10, pp. 763-767. Paris, 1916.

Observations made at the State Veterinary Station, Zambi. Belgian Congo.

I. LARVAE CAUSING ANIMAL MYIASIS IN THE LOWER CONGO.

I. OESTRIDAE (Gastricolous). — Larvae of *Cobboldia loxodontis* and *C. chrysidiformis* were found in the alimentary canal of an elephant. The occurrence of the latter species in other regions of Tropical Africa is not definitely ascertained.

In the stomachs of asses of both sexes of the Lombardy and Poitou races, larvae were observed corresponding to the *Gastrophilus intestinalis* of Europe. Some of these reared in the laboratory gave adults closely resembling the *G. asininus* form distinguished by BRAUER and which the authors regard as a geographical variety of the *G. intestinalis* of Europe. Warble-flies have been introduced into the Lower Congo contemporaneously with the importation of foreign horses, and have become acclimatised.

They did not exist there originally owing to the absence of horses, either tame or wild.

MUSCIDAE. — Myiasis due to *Chrysomyia* (*Pycnosoma*) *bezzianum* Vill. = *megacephala* Bezzi, is often observed among cattle. Hitherto this myiasis had only been encountered among oxen and horses; at Zambi it is also found in pigs. It has also been observed on a young domesticated antelope (*Tragelaphus scriptus*). It seems therefore that in nature wild mammals must also suffer from this cause. In the cases observed at Zambi, the myiasis was always the result of complications deriving from wounds.

Larvae of *Lucilia argyrocephala* Macq. were collected on a Barbary duck and on a fowl. This parasite, which hitherto has only been recorded upon mammals and upon man, appears to be of wide occurrence even among birds. Larvae of *L. argyrocephala* and *Passeromyia heterochaeta* Vill. have been found in the nest of *Ploceus collaris*; apparently the myiasis caused by *L. argyrocephala* is the direct consequence of the previous parasitic action of the haemophagous larvae of *Passeromyia*.

II. BITING INSECTS AND ACARINI COLLECTED ON LIVE STOCK AT ZAMBI.

TABANIDAE. — *Haematopoda perturbans* Edw. (probable transmitter of *Trypanosoma cazalboni*), *Tabanus canus* Karsch; *T. ditaeniatius* Macq.; *T. pluto* Walk; *T. par* Walk; *T. biguttatus* W; *T. taeniola* P. B.

STOMOXIDAE. — *Stomoxys calcitrans*, common on live-stock; *Lyperosia pallidipes* occurring in large numbers on cattle.

PULICIDAE. — The "chigoe" of man, *Sarcopsylla penetrans* L. infests pigs to such an extent as to constitute a serious obstacle to their breeding. *S. gallinacea* infests poultry and cats.

LICE. — *Haematopinus suis* L., frequently occurring on native or imported pigs. *H. eurysternus* has been observed on cattle. *H. tuberculatus* Grib. var. *penicillatus* has been collected on a buffalo imported from Italy; it has not been possible to determine whether this parasite is of European origin or not.

ACARINI. — *Psoroptes communis* var. *caprae*, on goats, cattle and domesticated rabbits. The authors regard this parasite as having been introduced from Europe, similarly *Dermanyssus gallinae*, *Cnemidocoptes mutans* (common on poultry) and *Chorioptes equi* Her. (on the horse).

IXODIDAE. — Among ticks collected on animals at Zambi the following have been identified:

*Rhipicephalus appendiculatus* Neumann; *Rh. simus* Koch and *Rh. capensis* Koch; *Amblyomma variegatum* Fabr. and *A. splendidum* Giebel; *Margaropus annulatus* Say; *Amblyomma tholloni* Neumann has been collected on an elephant from Kassai. The human tick, *Ornithodoros moubata*, has been encountered in large numbers on the pig at Paso Kondé (between Boma and Zambi); a search for spirillae on these *Ornithodoros* has given negative results, moreover "tick fever" is non-existent in the locality. *O. moubata* on the pig has already been recorded by WELLMANN in Angola (1).

255 - **Studies on Contagious Abortion in Mares.** — COMINOTTI LUIGI in *La Clinica Veterinaria*, Year XXXIX, No. 24, pp. 705-716. Milan, December 30, 1916.

Contagious abortion usually develops in regions where breeding of selected races is carried on, and occurs more especially in imported mares. In European countries it is chiefly recorded in Holland and Belgium and in the Italian provinces of Cremona and Mantua, i.e. in those parts where horse-breeding is most developed.

It is in Belgian mares that this type of abortion is most frequently observed. It is unaccompanied by any observable phenomena, whether general or local. The writer has never observed any posthumous evidence to account for the abortion.

The foetus and foetal membranes have been submitted to bacteriological examination. Aerobic and anaerobic cultures of the various organs of the foetus have been prepared. The anaerobic cultures have always

(1) See also No. 216 of this *Bulletin*.



remained sterile. The aerobic cultures have sometimes produced *Bacterium coli* and in other cases a staphylococcus has developed. The chief point of importance, however, has been the development, either alone or associated with one or both of the above organisms, of a bacterium related to *Bacterium coli* but not fermenting lactose. It shows the following characters:

Form coccobacillary.

Very motile.

GRAM negative.

Milk: non-coagulating.

Gelatine: non liquefying.

BARSIEKOW I (nutrose and glucose): fermented.

BARSIEKOW II (nutrose and lactose): non fermented.

HETSCH solution (nutrose and mannite): fermented.

PETRUSCHKY solution: first a faint red tinge, then blue.

DRIGALSKY agar: bluish colonies on blue ground.

ENDO agar: white colonies on colourless ground.

Development of indol: nil.

In view of these properties the microorganism most frequently isolated from aborted embryos must be placed in the sub-group *enteridis-paratyphum* B. The agglutination test with anti-swine fever serum gave agglutination at the maximum agglutination strength of the serum (1: 10 000).

With regard to the foetal membranes, a pure culture gave development of a streptococcus in one case only.

The writer has compared the strains of bacteria isolated with strains forwarded from the Royal Institute of Sero-therapy of Rotterdam and Utrecht isolated from aborted foetuses derived from different parts of Holland. The Dutch and Italian strains (Piadena, Prov. of Cremona) were identical.

In order to determine the reciprocal behaviour of the 3 strains with respect to their different immune serums, subcutaneous and endo-peritoneal inoculations were made on guinea-pigs with gradually increasing doses of cultures of the 3 strains: the animals were killed when the agglutination concentration reached 1: 2 000. Each of the 3 serums was then agglutinated by the serums of the 2 other serums at the same concentration as the corresponding serum.

Agglutination tests both with normal serum of mares and with the serum of mares which had aborted always gave negative results.

Inoculation of cultures of paratyphus B on pregnant ewes, either per vagina or mouth gave negative results. Similarly with endo-vaginal inoculation of guinea-pigs.

Attempts to establish the presence of the bacillus isolated from the foetus in the vagina of mares which had aborted a few days previously were also useless.

The frequency with which the bacillus of the sub-group *enteridis paratyphum B* has been isolated from the organs of the aborted foetus justifies the theory held by several writers that this bacillus is the specific agent of abortion in horses. The problem, however, cannot yet be considered as settled.

256 - **Injury to Ducklings Caused by the Larvae of the Coleopteron *Dermestes lardarius*.** — BURKHARDT, FRANZ, in *Berliner Tierärztliche Wochenschrift*, 33rd Year, No. 4. pp. 44-45. Berlin, January 25, 1917.

In May 1916, the "Kaiser-Wilhelm-Institut für Landwirtschaft" in Bromberg (Germany) received for examination several larvae of a Coleopteron found in the nests of ducks, where they were awaiting the hatching of the eggs. Immediately after the piercing of the shell, the larvae enter the egg and attack the duckling, even entering the body. Some 6-8 larvae per egg were so found. Chicken broods were not usually attacked.

Examination has shown the larvae to be those of the Coleopter *Dermestes lardarius*, which is of common occurrence in shops stocking smoked meat (ham and bacon).

The Coleopter, which is dark black in colour, measures 7-9 mm in length. The female lays her oblong eggs, of comparatively large size, on smoked meat, etc.

The larva develops rapidly and after several months reaches double the length of the adult beetle. The upper portion of the larva is brown in colour, the underside white, and it possesses 3 pairs of relatively short legs. The last segment has 2 processes on its dorsal portion in the shape of small backwardly recurved hooks. The covering of bristles of various lengths is especially characteristic.

The life-cycle is completed very rapidly, so that there may be several generations in a year. The insect passes the winter in the adult state.

The mode of life of the larva is similar to that of the adult, but the fact, recorded by the present writer, that it even attacks ducklings, was not known with certainty. The writer recommends further research and experiments on this subject.

257 - **The Valuation of Feeding Stuffs.** — PFEIFFER, E. in *Fühlings Landwirtschaftliche Zeitung*, Year 65, Part. 21-22, pp. 484-507. Stuttgart, November 1-15, 1916.

FEEDS AND  
FEEDING.

Among the 3 resolutions passed by the German Federation of Agricultural Experiment Stations, there occurs the remark that the idea opened up by MACH gives promise of success but requires more thorough examination. Up to the present this suggestion has found no echo; Prof. LAUR alone has submitted the resolutions of the Federation to a critical analysis. He agrees broadly with the proposals formulated, but

on several points of more or less importance is led to adopt a different view (1). The present writer therefore considers it opportune to review the whole question anew.

#### I. ESTIMATION OF COMPENSATION FOR SHORT VALUE.

MACH has proposed to determine in the ordinary analysis of feeding stuffs for live-stock, not only the crude protein and fats, but also the moisture and ash content (similarly the starch content), to calculate the starch value of the food-stuff under examination by the aid of average coefficients of digestibility and those of KELLNER, and to use them as a basis for framing the guarantee supplied to the buyer. This new system is also supported by Prof. LAUR, who considers that in various aspects it requires completion. Seeing that the albuminoids are no longer to be valued separately, while valuation is to be made of the nutritive constituents of the plants contained in the food, this fact should naturally be taken into account in calculating the compensation to be allowed in the fodder trade in case of difference between the content guaranteed by the seller and that found by the buyer. According to Prof. LAUR, the best way to obtain this object consists in extending the guarantee to the nitrogen content of the food. The price of the kilo of nitrogen should in that case be fixed as far as possible by agreement between buyer and seller, according to whether pasture or arable land is involved, at 10-70 *pfennigs* (2) or, failing an arrangement of this kind, at 40 *pfennigs*. The writer thinks this latter method will prove to be the rule. He also considers that there is not sufficient motive in the estimation of the improvement for expressing the value of the manure directly. A supplement for the crude protein seems to meet the case better, and for the sake of simplicity the writer proposes to fix it at 10 *pfennigs* in round figures, a sum which is more or less intermediate between the values he recommends for the estimation of the manurial value of the nitrogen according to whether particular or average care is taken to prevent loss of nitrogen. These values are, respectively,

$$\frac{85 \times 80}{100} = 68 \text{ pf.} \text{ or } \frac{85 \times 60}{100} = 51 \text{ pf.} \text{ for the nitrogen and, in consequence,}$$

$$10.9 \text{ pf. or } 8.2 \text{ pf. for the crude protein (3).}$$

The following example shows how the estimate of the amount of compensation would be effected in comparison with the old method.

On the basis of an analysis a merchant feels justified in guaranteeing for a poppy-seed cake 37 % of crude protein, 8 % of fat and 61 % of starch equivalent. But for one reason or another he supplies another cake for which the check analysis gives: 32.03 % crude protein, 5.65 % fat and 55.53 % starch equivalent. The price is 14.25 marks per metric quintal. According to the old method the compensation to pay would be:

$$(37 + 8) - (32.03 + 5.65) = 7.32 \times \frac{14.25}{45} = 2.32 \text{ marks.}$$

(1) See B. 1915, No. 1334.

(2) For the purpose of this article it will be sufficient to regard 10 *pfennigs* as equivalent to 1 penny and a *mark* as equivalent to a shilling. (Ed).

(3) See *Die Landwirtschaftlichen Versuchsstationen*, Vol. 79-80, 1913, pp. 289 *et seq.*



According to the new method the calculation would be as follows:

For 4.97 % of crude protein too little at 10 <i>pf</i> g. per % . . . . .	0.50 mark
For 5.47 % of starch-equivalent too little at 17.3 <i>pf</i> g. per % . . . . .	0.95 mark
Compensation	1.45 mark

As may be seen from the above, the compensation to be paid according to the new method would be less, but this does not constitute a reason for rejecting it, as the effective deficit is established with more precision. Further, there is reason for hoping that in these conditions the trade would be more disposed to accept this new guarantee.

MACH himself is in doubt as to how his method would work with regard to foods with a high content of crude fibre, and especially in the case of attempted falsification with rice offals. In such cases the complete analysis of the food cannot give results capable of utilisation because it is impossible to take into consideration (at any rate, in a direct manner) the very different nutritive value of the pure feeds and of the substances employed for their falsification. The question appears in a still more unfavourable light where, for example, it is only wished to determine the moisture, ash, crude protein and fibre and to introduce into the calculation for the sum of fat + nitrogen free extract a factor derived from the composition of the pure food. The present writer has shown that MACH's doubts are well founded.

It results that the method of calculation proposed by MACH is, in the majority of cases, capable of rendering excellent service in the valuation of pure feeding stuffs. But it fails in the presence of falsification by means of substances of low food value. Until, therefore, a method has been found of completing the process by means of a microscopical examination, its application will involve a certain amount of danger which it would be imprudent to ignore. MACH's method, however, seems to form an excellent means of enlightening farmers as to the real nutritive value of the foods they buy. Further, by having recourse to microscopic analysis and to the determination of the crude fibre, it will be possible to estimate almost exactly the depreciation in value caused by falsifications.

## II. VALUATION OF COMMERCIAL FEEDING STUFFS.

The resolutions passed by the above mentioned Federation are agreed to by LAUR who limits himself to proposing a few modifications concerning the valuation of the manure. The present writer concedes straight away that the taking into consideration of the phosphoric acid and potash contents of the foods cannot claim to be of decisive importance. According to LAUR's table, however, the valuation of the feeding stuffs might be influenced by this factor, in extreme cases, to the extent of 1.73 *pf*g. per kg of starch equivalent. The writer considers that the completed method would naturally be too long for the calculation of compensation for short value. Notwithstanding, in the case mentioned, a single calculation only is involved, the results of which should be included in the tables with those intended for the valuation of the nitrogen. The amount of work involved is so small that, according to the writer, there is no reason to neglect it.

The writer does not agree with LAUR when he says « nitric nitrogen cannot as a general rule be taken as a standard of value for the nitrogen of food-stuffs, but in many cases recourse must be had to the nitrogen of green manure ». For, he says, one is obliged at the very start to admit that many farms which buy large quantities of concentrates

rich in albuminoids have also regular need of nitric nitrogen. Further, the nitrogen of green manure furnishes a less reliable value than that of nitric nitrogen. To this must be added the fact that a portion (varying considerably with the nature of the soil) of the nitrogen of green manure is not entirely bestowed gratis by the atmosphere, but is derived from the soil, whilst, on the other hand, the losses of nitrogen vary in an extraordinary manner according to the nature of the soil under which the green manure is turned. The case is very much the same with the nitrate, but the conditions with regard to this latter are much better known.

Finally, the writer harbours various doubts with regard to the proposal of LAUR to differentiate, in evaluating the manure, between the various types of stock farms. For the moment, however, there is no necessity to modify the resolutions of the Federation with regard to this point.

### III. VALUATION OF FEEDING STUFFS NOT USUALLY APPEARING ON THE MARKET.

The German Federation of Agricultural Experiment Stations has decided that the calculation of the manurial value of feeding stuffs not intended for the market should be effected following the same principles as for the commercial kinds except, however, that account should be taken of the organic matter. LAUR opposes the inclusion of the phosphoric acid and of the potash, as well as the organic matter. The writer argues that if LAUR's point of view be accepted, the manurial value of rye-straw, for instance, is considerably reduced, especially if it is utilised as litter. If then, this straw is given as a food to live-stock, it is possible, in certain conditions, that such utilisation may be expected to give greater advantages than are obtained by its employment as litter, and to a degree which the writer regards as inadmissible.

LAUR considers that the employment of the ordinary trade feeding stuffs as a basis of appreciation for feeding stuffs not occurring on the market, only rarely gives exact results. He proposed to employ, for instance, the market process of skimmed milk for the valuation of the foods richest in albuminoids, those of potatoes for other cultivated crops, these of meadow hay for dry fodders, etc. It is only in respect of cereal grains that he would allow the principles accepted for commercial feeding stuffs to stand. With regard to the above, the writer considers that: 1) very complicated situations would result; 2) it would entail the admission that the market prices of « Normal futtermittel » (normal feeding stuffs) were fixed values. The writer considers that these 2 points by no means constitute a step in advance but rather evoke considerable apprehension. Nor does the consideration of the degree of concentration, according to LAUR, meet with his approval.

Summing up, the writer admits that, where it is a case of the utilisation of feeding stuffs from the economical point of view, LAUR's method for the valuation of fodders not intended for the market offers several advantages. But, according to its own express statement the Federation of German Agricultural Experiment Stations only aims at fixing landmarks for the exact valuation of feeding stuffs not generally occurring on the market by comparison with the ordinary feeding stuffs of every day trade. And this special purpose is amply attained by the method proposed by the present writer. True, this process has the drawback of being a very long one but in this respect the method of LAUR shows no advantage.

258 - **Net Energy Values for Ruminants.** — ARMSBY, HENRY PRENTISS AND FRIES, J. AUGUST, in *The Pennsylvania State College, School of Agriculture, Agricultural Experiment Station, Bulletin No. 142*, 19 pp. State College, Centre County, Pennsylvania, July 1916.

HENRY and MORRISON (*Feeds and Feeding*, 15th. edition, Madison, Wis., pp. 633-666), have published a compilation of analyses of feeding stuffs and of the results of digestion experiments in North America, and on this basis have calculated the content of digestible nutrients (for ruminants) in a great variety of feeding stuffs. From these tables, the writers have computed the net energy values of the more important feeds in the manner which they had previously devised (1).

The results of their calculations are given in the following table, with regard to which it is to be remarked that: 1) Both the digestive coefficients used by HENRY and MORRISON, and the data for the expenditure of energy due to feed consumption are derived exclusively from experiments on ruminants. Consequently, the net energy values here computed are applicable to ruminants only, and not to horses, or swine; 2) the table shows primarily the net energy values for maintenance or fattening. There seems good reason for believing, however, that they may be taken to represent also the net energy values for growth and, at least, the relative values for milk production; 3) in comparing the figures for the various feeding stuffs, account should be taken of the moisture they contain when they are given to the animals; 4) HENRY and MORRISON's tables include only the crude protein ( $N \times 6.25$ ). The amount of non-protein has been estimated by the writers from the crude protein on the basis of KELLNER's averages.

*Average Dry Matter, Digestible Crude Protein, Digestible True Protein, and Net Energy, Values per 100 lbs. for Ruminants.*

	Dry matter — Lbs.	Digestible Crude protein — Lbs.	True protein — Lbs.	Net energy value — Therms
DRIED ROUGHAGE:				
<i>Hay and fodder from cereals:</i>				
Brome grass, smooth . . . . .	91.5	5.0	3.5	40.83
Corn fodder (ears included, medium dry) . . . .	81.7	3.0	2.3	43.94
Corn stover (ears removed, medium dry) . . . .	81.0	2.1	1.6	31.62
Millet, Hungarian . . . . .	85.7	5.0	3.9	46.96
Mixed timothy and clover . . . . .	87.8	5.3	3.2	41.07

(1) See *B.* 1913, No. 625.

(Ed.)



	Dry matter	Digestible		Net energy value
	Lbs.	Crude protein	True protein	Therms
Oat hay . . . . .	88.0	4.5	3.9	32.25
Orchards grass . . . . .	88.4	4.7	3.3	44.93
Red top . . . . .	90.2	4.6	3.9	51.22
Timothy, all analyses . . . . .	88.4	3.0	2.2	43.02
Timothy, before bloom . . . . .	92.8	4.7	2.9	43.52
Timothy, early to full bloom . . . . .	87.2	3.6	2.5	47.40
Timothy, late bloom to early seed . . . . .	85.1	2.4	1.8	37.54
Timothy, nearly ripe . . . . .	87.5	2.2	1.8	38.59

*Hay and fodder from legumes:*

Alfalfa, all analyses . . . . .	91.4	10.6	7.1	34.23
Alfalfa, before bloom . . . . .	93.8	15.4	10.3	36.23
Alfalfa, in bloom . . . . .	92.5	10.5	6.7	32.33
Alfalfa, in seed . . . . .	89.6	8.5	6.2	32.23
Clover, alsike . . . . .	87.7	7.9	5.3	34.42
Clover, crimson . . . . .	89.4	9.7	6.9	36.21
Clover, red, all analyses . . . . .	87.1	7.6	4.9	38.68
Clover, red, before bloom . . . . .	89.6	11.6	5.4	42.17
Clover, red, in bloom . . . . .	86.1	8.1	5.3	39.12
Clover, red, after bloom . . . . .	77.9	6.8	4.5	34.51
Clover, sweet, white . . . . .	91.4	10.9	6.7	38.98
Cowpeas, all analyses . . . . .	90.3	13.1	9.2	37.59
Cowpeas, before bloom . . . . .	92.2	17.8	12.8	33.54
Cowpeas, in bloom to early pod . . . . .	89.4	12.6	9.5	39.11
Soybeans . . . . .	91.4	11.7	8.8	44.03

*Straws:*

Barley . . . . .	85.8	0.9	0.6	36.61
Buckwheat . . . . .	90.1	4.2	3.2	4.55
Oat . . . . .	88.5	1.0	0.8	34.81
Rye . . . . .	92.9	0.7	0.5	17.59
Wheat . . . . .	91.6	0.7	0.3	7.22

FRESH GREEN ROUGHAGE:

*Green cereals, etc.:*

Barley fodder . . . . .	23.2	2.3	2.0	14.08
Blue grass, Kentucky, before heading . . . . .	23.8	3.7	2.8	14.82
Blue grass, Kentucky, headed out . . . . .	36.4	2.8	2.2	17.77
Blue grass, Kentucky, after bloom . . . . .	43.6	1.9	1.6	21.01
Buckwheat, Japanese . . . . .	36.6	2.2	1.5	17.78
Cabbage . . . . .	8.9	1.9	1.3	8.87
Cabbage, waste outer leaves . . . . .	14.1	1.7	1.1	7.05
Corn fodder, dent, all analyses . . . . .	23.1	1.0	0.8	14.60
Corn fodder, dent, in tassel . . . . .	14.9	1.1	0.8	9.52

	Dry matter	Digestible		Net energy value
		Crude protein	True protein	
	Lbs.	Lbs.	Lbs.	Therms
Corn fodder, dent, in milk . . . . .	19.9	1.0	0.8	13.64
Corn fodder, dent, dough to glazing . . . . .	25.1	1.3	1.0	17.35
Corn fodder, dent, kernels glazed . . . . .	26.2	1.1	0.8	16.74
Corn fodder, dent, kerpels ripe . . . . .	34.8	1.5	1.1	22.48
Corn fodder, flint, all analyses . . . . .	20.7	1.0	0.8	13.53
Corn fodder, flint, in tassel . . . . .	10.6	0.9	0.7	6.89
Corn fodder, flint, in milk . . . . .	15.0	0.9	0.7	10.39
Corn fodder, flint, kernels glazed . . . . .	21.0	1.0	0.8	13.49
Corn fodder, flint, kernels ripe . . . . .	27.9	1.2	0.9	17.84
Corn fodder, sweet, before milk stage . . . . .	10.0	0.8	0.6	7.82
Corn fodder, sweet, roasting ears or later . . . . .	20.3	1.2	0.9	13.38
Corn fodder, sweet, ears removed . . . . .	21.5	1.0	0.8	14.26
Millet, Hungarian . . . . .	27.6	1.9	1.1	17.24
Oat fodder . . . . .	26.1	2.3	2.0	14.06
Orchard grass . . . . .	29.2	1.7	1.1	15.81
Rape . . . . .	16.7	2.6	1.7	13.07
Rye fodder . . . . .	21.3	2.1	1.4	15.99
Sweet sorghum fodder . . . . .	24.9	0.7	0.4	15.37
Timothy, before bloom . . . . .	24.2	1.8	1.1	18.36
Timothy, in bloom . . . . .	32.1	1.3	0.8	18.89
Timothy, in seed . . . . .	46.4	1.5	1.0	26.36
Wheat fodder . . . . .	27.4	2.8	1.9	18.75

*Green legumes:*

Alfalfa, before bloom . . . . .	19.9	3.5	1.9	9.20
Alfalfa, in bloom . . . . .	25.9	3.3	1.8	11.50
Alfalfa, after bloom . . . . .	29.8	2.1	1.3	11.10
Clover, alsike . . . . .	24.3	2.7	1.5	14.56
Clover, crimson . . . . .	17.4	2.3	1.6	10.83
Clover, red, all analyses . . . . .	26.2	2.7	1.7	15.87
Clover, red, in bloom . . . . .	27.5	2.7	1.8	16.74
Clover, red, rowen . . . . .	34.4	3.3	2.2	17.30
Cowpeas . . . . .	16.3	2.3	1.7	10.42
Peas, Canada field . . . . .	16.6	2.9	2.1	9.78
Soybeans, all analyses . . . . .	23.6	3.2	2.4	12.53
Soybeans, in bloom . . . . .	20.8	3.0	2.3	10.44
Soybeans, in seed . . . . .	24.2	3.1	2.5	12.70
Vetch, hairy . . . . .	18.1	3.5	2.4	11.95

## SILAGE:

Corn, well-matured, recent analyses . . . . .	26.3	1.1	0.6	15.90
Corn, immature . . . . .	21.0	1.0	0.4	11.96
Corn, from frosted ears . . . . .	25.3	1.2	0.6	14.27
Corn, from field-cured stover . . . . .	19.6	0.5	0.3	8.98

	Dry matter	Digestible		Net energy value
	Lbs.	Crude protein	True protein	Therms
Clover . . . . .	27.8	1.3	0.8	7.26
Cowpeas . . . . .	22.0	1.8	1.1	11.05
Soybeans . . . . .	27.1	2.6	1.5	11.59
Sugar beet pulp . . . . .	10.0	0.8	0.5	9.32

## ROOTS, TUBERS AND FRUITS:

Apple . . . . .	18.2	0.4	0.1	15.92
Beet, common. . . . .	13.0	0.9	0.1	7.84
Beet, sugar . . . . .	16.4	1.2	0.4	11.20
Carrot . . . . .	11.7	0.9	0.5	9.21
Mangels . . . . .	9.4	0.8	0.1	5.68
Potatoes . . . . .	21.2	1.1	0.1	18.27
Pumpkin, field . . . . .	8.3	1.1	0.6	6.05
Rutabaga . . . . .	10.9	1.0	0.3	8.46
Turnip. . . . .	9.5	1.0	0.4	6.16

## GRAINS:

*Cereal grains:*

Barley . . . . .	90.7	9.0	8.3	89.94
Buckwheat . . . . .	87.9	8.1	7.2	59.73
Corn, dent . . . . .	89.5	7.5	7.0	89.16
Corn, flint . . . . .	87.8	7.7	7.2	87.50
Corn and cob meal . . . . .	89.6	6.1	5.7	75.80
Corn meal. . . . .	88.7	6.9	6.4	88.75
Oats. . . . .	90.8	9.7	8.7	67.56
Oat meal . . . . .	92.1	12.8	11.5	86.20
Rye . . . . .	90.6	9.9	9.0	93.71
Wheat, all analyses. . . . .	89.8	9.2	8.1	91.82
Wheat, winter. . . . .	89.1	8.7	7.7	91.66
Wheat, spring. . . . .	89.9	9.2	8.1	91.41

*Leguminous seeds:*

Bean, navy. . . . .	86.6	18.8	16.4	73.29
Cowpea . . . . .	88.4	19.4	16.9	79.46
Pea, field. . . . .	90.8	19.0	16.6	78.72
Pea meal. . . . .	89.1	19.8	17.2	77.62
Peanut with hull. . . . .	93.5	19.4	16.9	83.15
Peanut kernel . . . . .	94.0	24.1	22.2	109.04
Soybean . . . . .	90.1	30.7	27.3	81.29

*Oil seeds:*

Cotton seed. . . . .	90.6	13.3	11.9	78.33
Flax seed. . . . .	90.8	20.6	19.2	83.17
Sunflower seed . . . . .	95.5	23.3	20.2	95.77
Sunflower seed with hulls. . . . .	93.1	13.5	11.7	92.49



	Dry matter — Lbs.	Digestible Crude protein — Lbs.	True protein — Lbs.	Net energy value — Therms
DAIRY-PRODUCTS:				
Buttermilk . . . . .	9.4	3.4	3.4	13.32
Cow's milk . . . . .	13.6	3.3	3.3	29.01
Skim milk—centrifugal . . . . .	9.9	3.6	3.6	14.31
Skim milk—gravity. . . . .	9.6	3.1	3.1	15.43
Skim milk—dried. . . . .	91.7	34.4	34.4	103.91
Whey . . . . .	6.6	0.8	0.8	10.39

## By-PRODUCTS:

*Fermentation industries:*

Brewers' grains, dried . . . . .	92.5	21.5	20.2	53.38
Brewers' grains, dried, below 25 % protein . . . . .	91.8	18.7	17.5	50.93
Brewers' grains, wet . . . . .	24.1	4.6	4.4	14.53
Distillers' grains, dried, from corn . . . . .	93.4	22.4	18.3	85.08
Distillers' grains, dried, from rye. . . . .	92.8	13.6	11.1	56.01
Distillers' grains, wet. . . . .	22.6	3.3	2.8	22.05
Malt . . . . .	94.2	15.8	11.8	87.82
Malt sprouts . . . . .	92.4	20.3	12.5	72.72

*Milling:*

Buckwheat bran. . . . .	88.8	10.5	9.1	30.59
Buckwheat hulls . . . . .	89.7	0.4	?	7.69
Buckwheat middlings . . . . .	88.0	24.6	20.8	72.19
Hominy feed . . . . .	89.9	7.0	6.5	81.31
Rye bran. . . . .	86.6	12.2	10.5	79.35
Wheat bran . . . . .	89.9	12.5	10.8	53.00
Wheat middlings, flour . . . . .	89.3	15.7	14.0	75.02
Wheat middlings, standard. . . . .	89.6	13.4	12.0	59.10

*Oil extraction:*

Cocoanut meal, low in fat. . . . .	90.4	18.8	18.3	83.49
Cocoanut meal, high in fat . . . . .	92.3	18.4	18.0	100.31
Cottonseed hulls. . . . .	90.3	0.3	?	9.92
Cottonseed meal, choice. . . . .	92.5	37.0	35.4	93.46
Cottonseed meal, prime. . . . .	92.2	33.4	32.0	90.00
Germ oil meal, corn . . . . .	91.1	16.5	14.3	83.88
Linseed meal, new process. . . . .	90.4	31.7	30.9	85.12
Linseed meal, old process. . . . .	90.9	30.2	28.5	88.91
Palmnut cake . . . . .	89.6	12.4	12.0	94.18
Peanut cake from hulled nuts . . . . .	89.3	42.8	41.4	93.55
Peanut cake, hulls included . . . . .	94.4	20.2	19.5	42.57
Soybean meal, fat extracted . . . . .	88.2	38.1	37.3	99.65
Sunflower seed cake . . . . .	90.0	32.0	29.1	88.87

	Dry matter — Lbs.	Crude protein — Lbs.	Digestible <sup>6</sup> True protein — Lbs.	Net energy value — Terms
<i>Starch manufacture:</i>				
Gluten feed . . . . .	91.3	21.6	20.1	80.72
Gluten meal . . . . .	90.9	30.2	28.1	84.15
Starch feed, dry . . . . .	90.7	12.2	9.2	77.46
Starch feed, wet . . . . .	33.4	4.1	3.7	30.45
<i>Sugar manufacture:</i>				
Molasses, beet . . . . .	74.7	1.1	0.0	57.10
Molasses, cane or black strap . . . . .	74.2	1.0	0.0	55.38
Molasses beet pulp . . . . .	92.4	5.9	3.5	76.28
Sugar beet pulp, dried . . . . .	91.8	4.6	0.7	75.87
Sugar beet pulp, ensiled . . . . .	10.0	0.8	0.5	9.32
Sugar beet, wet . . . . .	9.3	0.5	0.5	8.99
<i>Packing house:</i>				
Dried blood . . . . .	90.3	69.1	68.6	68.12
Tankage				
Over 60 % protein . . . . .	92.6	58.7	55.6	93.04
55-60 % protein . . . . .	92.5	54.0	51.1	83.58
45-55 % protein . . . . .	92.5	48.1	45.5	72.96
Below 45 % protein . . . . .	93.5	37.6	35.6	54.16

259 - **Chemical Composition, Digestibility and Feeding Value of Vegetable-Ivory Meal.** — BEALS, C. L. AND. LINDSEY, J. B. (Massachusetts Agricultural Experiment Station) in *Journal of Agricultural Research*, Vol. VII, No. 7, pp. 301-320, Washington D. C. November 13, 1916.

Vegetable ivory, or the corozo nut is the seed of *Phytelphas macrocarpa* (1) a plant found in great quantities in Colombia and which also grows in Peru and North Ecuador. The nuts are largely imported by Great Britain and Germany, while the United States use about 10,000 tons annually, costing \$ 1 500 000. In the process of manufacture, a considerable portion of the nut is wasted in the form of sawdust, chips and turnings. In some countries this residuum has been mixed with other ingredients to be used as cattle fond. German writers state that vegetable-ivory meal has been employed to the extent of 50 per cent as an adulterant

(1) *Phytelphas macrocarpa* R. and P., a *Pandanaceae*. This plant must not be confused with *Coelococcus carolinensis* ? a Polynesian palm which, together with other plants, supplies a similar product, also called vegetable ivory. Cf. WEHMER, *Pflanzenstoffe*, 1911, p. 74.

in the manufacture of so-called concentrated feeds (1). In the last few years, many attempts have been made in the United States to discover a practical use for this waste material (2).

The writers have made many chemical investigations of vegetable ivory and have tried to determine the mannose present, for the corozo nut has been regarded as a source of this sugar.

From the results of this work have been obtained the data given in Table I which gives the writers' fodder analyses of vegetable ivory, together with the German analyses for purposes of comparison.

TABLE I. — *Fodder Analyses of Vegetable Ivory.*

Constituent	Max.	Min.	Average of 9 samples	German analyses (for comparison)
Moisture . . . . .	12.64 %	6.13 %	11.39 %	18.30 — 13.20 %
Ash . . . . .	2.30	0.80	1.08	1.30 — 1.10
Protein . . . . .	5.56	3.94	4.63	4.60 — 4.00
Fat . . . . .	1.18	0.60	0.92	1.10 — 0.80
Fibre . . . . .	7.75	6.13	6.89	} 79.80 — 75.80
Nitrogen-free extract . . . . .	77.56	74.17	75.09	

Vegetable ivory chiefly consists of carbohydrates, and especially of mannan, the anhydrid condensation product of mannose which is present to the extent of 92.5 per cent. No lignin, starch, or dextrose, are to be found, but about 2.43 per cent of the dry matter consists of pentosans. An undetermined carbohydrate of the nature of pectin has also been observed. Water extracts of vegetable ivory meal gave about 0.5 per cent of reducing sugars, while the same solution after hydrolysis with hydrochloric acid, gave an average of 2 per cent of reducing material.

It was noticed that 5 hours' boiling was necessary to hydrolyse completely the mannose and other reducing materials, and the determination of the reducing sugars proves that the nitrogen-free extract is accounted for in the form of a hexose sugar, or its condensation product, except a small percentage of pentoses and pectin.

A number of bomb-calorimeter determination have been made to deter-

(1) Especially for adulterating palm oil cake. (A. EMMERLING Ueber Palmkernkuchen und-mehl, in *Die Futtermittel des Handels* published by the Verband Landwirtschaftlicher Versuchs-Stationen im Deutschen Reich, XVII, pp. 316-317, 1906. In Italy, corozo meal has of late been used in the adulteration of the olive residuum sold as cattle food.

[Ed.]

(2) See also: FORMENTI, *Stazioni sperimentali agrarie*, XXXV, p. 229, 1902.

[Ed.]



mine the average calorific value of vegetable-ivory, which proves to amount to 3.785 calories per gram, and is not very different from that of maize flour, sugar and maize starch. In button factories, however, where the ivory waste is used under the boilers as fuel, it has been stated that it produces about half as much heat as soft coal.

Two experiments, with 3 and 2 sheep respectively, were carried out to determine the digestibility of vegetable ivory meal. The animals ate it readily when it was fed with hay, maize gluten, salt and water *ad lib.* In a 3rd experiment it was found that the carbohydrates of the corozo nut are hydrolyzed and absorbed in the digestive tract of sheep. In the two first experiments were obtained the digestion coefficients of maize meal and vegetable ivory meal given in Table II.

TABLE II. — *Comparison of digestion coefficients obtained in Experiments I and II.*

Feed	Dry matter	Protein	Fat	Fibre	Nitrogen free extract
Vegetable ivory meal . . . .	84%	36%	51%	72%	92%
Maize meal . . . . .	88	67	90	—	92

Applying these coefficients to the composition of the dry matter, we obtain the following amounts of digestible matter in 1 ton of each of the 2 feeds. (Table III).

TABLE III. — *Digestible nutrients (in pounds) in vegetable ivory meal and maize meal per ton.*

Feed	Protein	Fat	Fibre	Nitrogenous free extract	Total
Vegetable ivory meal . .	42.34 lb.	6.83 lb.	101.08 lb.	1,582.20 lb.	1,732.45 lb.
Maize meal . . . . .	147.52	78.84	—	1,486.60	1,712.76

Feeding experiments made on cows showed that these animals ate vegetable-ivory meal, when mixed with other feed, without evidence of digestive disturbances. They refused to eat it if fed by itself.

When the vegetable-ivory meal (3 lb. per day) was fed in addition to a somewhat limited daily ration consisting of: 18.67 lb. hay — 2.34 lb. wheat bran — 2 lb. cottonseed meal and 1 lb. hominy, the experiment showed the favourable effect of the ivory meal. The addition of the latter increased the milk flow 5.7 per cent and its removal caused a decrease of 4.2 per cent. In a similar experiment, where the basal ration was somewhat below what the animals required for maintenance and normal milk production,

the addition of the vegetable-ivory meal produced an increase of 3.46 per cent in the milk yield, which corresponds to 1 lb. of milk per 3.56 lb. of ivory meal.

Two other comparative experiments were also made, in the one was given an average daily ration of: 2.36 lb. wheat bran + 2.28 lb. cotton seed meal + 20.58 lb. hay, to which were added 3.36 lb. maize meal, or 3 lb vegetable-ivory meal: in the other experiment, the rations fed were: 2.38 lb. bran + 2.19 lb. cotton seed meal + 18.5 lb. hay to which were added, either 3.75 lb. ivory meal, or 4.01 maize meal. A summary of the results is given in Table IV.

TABLE IV. — *Five Weeks' Milk Production.*

Number of Cows	Ration	Milk Produced	Dry Matter	Fat
6	basal + 3.36 lb. maize meal. . . . .	5,243.5 lb	13.37 %	4.56 %
6	basal + 3.00 lb. vegetable-ivory meal* . . .	5,072.7	13.45	4.65
8	basal + 4.01 lb. maize meal. . . . .	6,931.3	13.50	4.87
8	basal + 3.75 lb. vegetable-ivory meal. . . .	6,403.3	13.47	4.93

\* 2 cows were given in addition 1 lb maize meal.

Though the methods of feeding necessarily followed were not such that exact relative values could be shown, it seems certain that vegetable-ivory meal does not fully equal maize meal for milk production.

In the appendix there is a bibliographical list of 14 publications.

260 - **Comparative Results of Feeding Guinea-Pigs with Whole Grains of Barley in the "Quiescent" and in the Germinating State.** — WEILL, E. and MOURIQUAND, G., in *Comptes Rendus des Séances de la Société de Biologie*, Vol. LXXX, No, 1, pp. 33-35. Paris, January 6, 1917.

The writers have shown previously (1) that feeding of pigeons on an exclusive diet of whole raw grains of barley (or of any other uncorticated cereal) is capable of preserving complete nutritional equilibrium and does not induce nervous disorders of the beri-beri type such as are caused by the use of decorticated cereal grains. It is important to investigate what action a similar type of feeding may have on the nutrition of a mammal such as the guinea-pig of which barley grains in the dry state do not constitute the usual food,

Two guinea-pigs were put on a daily ration of 25 grams of completely raw barley. and two others on a ration of the same barley allowed to germinate at a suitable temperature for 3 days.

(1) See *B.* 1916, No. 415.

(Ed).

The comparison of the 2 sets of experiments show that a ration of whole barley when consumed in the "dry" state resulted in rapid denutrition of the guinea-pigs with fatal termination on the 29th. or 30th. day, whereas an equal ration of this same barley, consumed on the third day of germination, maintained nutrition at the normal level (or nearly so, with period of growth) for 106 days in one case (death on 114th. day) and for 69 days in another (death on the 74th. day).

Throughout the course of the experiment it seemed as if the grain in the "quiescent" state did not contain in suitable form the elements necessary for the nutrition of the guinea-pigs, and as if germination had developed in the grain a substance (or group of substances) capable of supporting nutrition at the normal level for a long period.

**261 - Improvement in the Method of Apportioning the Mangel Ration. —**

*Feuille d'Informations du Ministère du Commerce, de l'Industrie, du Travail, des Postes et des Télégraphes, France. Year XXII, No. 2, p. 10. Paris, January 9, 1917.*

The whole of the nutritive principles contained in mangels at the moment of harvest undergo losses and modifications, sometimes to a considerable extent, during storage.

The sugars, particularly, gradually disappear. After 3 months storage in the silo 6 to 8 % of the sugar has vanished, in spite of the weight of the root remaining the same. After 4 months, the loss reaches 15 % and after 6 months, 25 %.

The nitrogenous matters, the total weight of which remains the same, undergo an unfavourable transformation from the nutritive point of view. The total dry matter even is 10 to 12 % lower than at the time of harvest.

If the animals are to receive constantly the same quantity of nutritive elements it is therefore necessary to increase in a progressive manner the daily weight of mangels administered.

Though it is difficult to give precise indications as to the scale of increase (the nutritive value of mangels varying as much as 100 % according to variety and conditions) it may be said that after 2 months' storage the quantity figuring in the daily ration should be increased by 10 % in order to give the same food value.

After 4 months' storage, the increase should be 15 to 18 % and after 6 months, about another 15 %.

**262 - Feeding Tests for the Toxic Effect of the Seeds of *Adonis aestivalis* contained in Milling Residues in Hungary. —** See No. 279 of this *Bulletin*.

**263 — Data on the Measurement of Inbreeding. —** PEARL, RAYMOND, in *Thirty-First Annual Report of the Maine Agricultural Experiment Station, Bulletin 243*, pp. 225-248. 5 Fig. Orono, Maine, 1916.

The pedigree of an individual consists of two halves. One of these



halves is made up of the sire and his ancestors; the other of the dam and her ancestors.

The coefficients of inbreeding for a particular pedigree are composed of the following elements:

1) The repeated occurrence of the same individual animals (types) on the sire's side of the pedigree only.

2) The repeated occurrence of the same individual animals on the dam's side of the pedigree only.

3) The re-appearance of animals which appear first on one side of the pedigree (either the sire's or the dam's) then on the other side.

If only 1 and 2 are to be found in the pedigree, it means that the sire and the dam are totally unrelated (within the limits covered by the pedigree in the particular case). On the other hand, the re-occurrence of 3 means that the sire and dam are in some degree related and that a portion of the observed inbreeding arises from that fact.

The coefficients of inbreeding are calculated from the following formula,

$$Z_n = 100 \frac{(p_{n+1} - q_{n+1})}{p_{n+1}}$$

where  $p_{n+1}$  denotes the maximum possible number of different individuals involved in the matings of the  $n + 1$  generation and  $q_{n+1}$  the actual number of different individuals involved in these matings. Thus  $Z_n$  (or more simply  $Z$ ) is the coefficient of inbreeding and its value is from 0 to 100. If this formula is used for continued mating of brothers and sisters in a succeeding series of generations:  $Z_0 - Z_1 - Z_2 - Z_3$ , for  $Z_0$  we have

$p = 2$  and  $q = 2$ : consequently  $Z_0 = \frac{100(0)}{2} = 0$ , and in a similar

manner,  $Z_1 = \frac{100(4 - 2)}{4} = 50$ ;  $Z_2 = \frac{100(8 - 2)}{8} = 75$ ;  $Z_3 =$

$$\frac{100(16 - 2)}{16} = 87.5.$$

Now, the coefficients of inbreeding of themselves tell us nothing about what proportionate part has been played by the 3 elements in reaching the final result, nor do they reveal a possible relationship between the two members of the original pair.

The writer proposes a method for recognising and estimating these successive values. The ordinary pedigree is divided into 4 parts:

1) The first table includes the primary re-appearance on the sire's side of the pedigree of such animals as appear first on the same side.

2) The 2nd Table includes the primary re-appearance on the dam's side of such animals as first appear on the same side.

3) The 3rd Table includes the primary appearance on the dam's side of such animals as first appear on the sire's side.

4) The 4th Table includes the primary appearance on the sire's side of such animals as first appear on the dam's side.

The values of these last two Tables give the degree of relationship between the original couple.

King Melia Rioter is a pedigree Jersey bull (a type animal) which first appeared on the sire's side of the pedigree. In the 5th Table, where we find the primary re-appearances on the dam's side of the pedigree of animals which first appear on the sire's side we have:

Generations . . . . .	2	3	4	5	6	7	8	9	10	11	12
King Melia Rioter. . . . .	1	(2)	(4)	—	—	—	—	—	—	—	—
St Lambert's Rioter King. . . . .	—	—	1	(10)	—	—	—	—	—	—	—
King of St Lambert . . . . .	—	—	—	1	—	—	—	—	—	—	—
St Lambert Boy . . . . .	—	—	—	1	(24)	—	—	—	—	—	—
St Lambert Boy . . . . .	—	—	—	—	2	—	—	—	—	—	—
Oakland's Nora. . . . .	—	—	—	—	1	—	—	—	—	—	—
St Lambert's Rioter King. . . . .	—	—	—	—	1	(56)	—	—	—	—	—
St Lambert Boy . . . . .	—	—	—	—	—	1	—	—	—	—	—
King of St Lambert . . . . .	—	—	—	—	—	1	—	—	—	—	—
St Lambert's Letty . . . . .	—	—	—	—	—	1	(118)	—	—	—	—
Letty Coles 2d. . . . .	—	—	—	—	—	—	1	(238)	—	—	—
King of St Lambert . . . . .	—	—	—	—	—	—	—	1	—	—	—
Louise's Grace . . . . .	—	—	—	—	—	—	—	1	—	—	—
<i>Totals . . . . .</i>	1	2	5	12	28	59	119	240	480	960	1 920

From this Table it is obvious that a very considerable portion of the inbreeding shown in the pedigree of King Melia Rioter arises from the fact that his sire and dam were closely related. The 4 Tables relating to King Melia Rioter can be summarised as follows:

Generations . . . . .	2	3	4	5	6	7	8	9	10	11	12
Male only (Table I) . . . . .	—	—	1	3	16	41	105	210	447	898	1 796
Female only (Table II) . . . . .	—	—	—	1	2	4	8	16	32	64	128
Cross-over (Tables III and IV) . . . . .	1	2	5	12	28	59	119	240	480	960	1 920
<i>Totals . . . . .</i>	1	2	6	16	46	104	232	475	959	1 922	3 844

If the coefficient of inbreeding is calculated only from the values given in Tables III and IV, another coefficient, the "coefficient of relationship" is obtained = K. This shows the influence of the relationship of the ancestral pair upon the marks of inbreeding observed in their descendants. The two coefficients, the inbreeding coefficient, Z, and the relationship

coefficient, K, are with some limitations independent of one another, as may be seen from the following Table:

Generations	Maximum Possible Value of Z when K = 0	Maximum Possible Value of Z when K = 100
A <sub>1</sub> . . . . .	0	0
A <sub>2</sub> . . . . .	0	50.00
A <sub>3</sub> . . . . .	50.00	75.00
A <sub>4</sub> . . . . .	75.00	87.50
A <sub>5</sub> . . . . .	87.50	93.75
A <sub>6</sub> . . . . .	93.75	96.88
A <sub>7</sub> . . . . .	96.88	98.44
A <sub>8</sub> . . . . .	98.44	99.22
A <sub>9</sub> . . . . .	99.22	99.61
A <sub>10</sub> . . . . .	99.61	99.80

From this it appears: 1) that Z and K are within certain limits independent: 2) that after 10 generations the coefficient (degree) of inbreeding is the same, whether the ancestral pair were related or not.

But if *quantitatively* the result is the same, the germinal constitution of the individual produced, would, except by the most remote chance, be quite different in the two cases. The method suggested by the writer permits of this *qualitative* difference in the descendants being estimated.

264 - **The Herd and Stud Books of the Argentine Rural Society.** - *Anales de la Sociedad Rural Argentina*, Year 41, Vol. L, pp. 489-491. Buenos-Aires, September-October 1916.

STOCK RAISING  
ORGANISATION  
AND ENCOURAGEMENT.

The appended tables give the entries in the Herd and Stud Books of the above Society since its foundation, and also the entries for the

*Argentine Herd Book.*

Breeds	Entered between Oct. 1 1915 and Sept. 30, 1916				Entries since foundation		
	Imported		Bred in the Country		Imported and bred in the Country		
	Bulls	Cows	Bulls	Cows	Bulls	Cows	Total
Shorthorn . . . . .	402	96	4 069	4 244	45 331	48 502	93 833
Hereford . . . . .	13	—	554	556	8 613	10 794	19 407
Aberdeen Angus . . . . .	32	11	583	558	4 009	4 325	8 334
Red Shorthorn . . . . .	2	—	6	7	138	196	334
Red Polled . . . . .	—	—	13	12	99	112	211
Devon . . . . .	—	—	1	2	15	20	35
Jersey . . . . .	2	5	10	9	35	43	78
Flemish . . . . .	—	—	30	36	134	465	599
Totals . . . . .	451	112	5 266	5 224	58 374	64 457	122 831



*Argentine Stud Book.*

Breeds	Entered between Oct. 1, 1915 and Sept. 30, 1916		Entries since foundation (1907)		
	Stallions	Mares	Stallions	Mares	Total
Percheron . . . . .	298	358	3 323	5 492	7 818
Clydesdale . . . . .	145	221	1 842	4 695	6 537
Hackney . . . . .	185	180	1 802	2 685	4 487
Shire . . . . .	124	164	1 699	3 199	4 808
Yorkshire . . . . .	26	52	262	705	967
Suffolk-Punch . . . . .	13	40	180	519	699
Boulonnais . . . . .	18	25	144	195	399
Anglo-Norman . . . . .	7	30	182	651	833
Hunter . . . . .	10	21	50	151	201
Polo-Pony . . . . .	5	11	64	80	144
Orloff . . . . .	6	9	87	110	197
American Trotting . . . . .	2	7	5	23	28
Belgian . . . . .	2	4	21	70	91
Shetland-Pony . . . . .	1	2	10	24	34
Oldenbourger . . . . .	1	2	10	15	25
Holstein . . . . .	1	—	10	11	21
Trakehnen . . . . .	—	—	2	—	2
<i>Totals.</i> . . . .	844	1 126	8 603	18 625	27 228

*Argentine Flock Book.*

Breeds	Entries from Oct. 1, 1913 to Sept. 30, 1916						Number of breeding animals entered finally and in trial at the same period			
	Imported		Bred in the Country		Preparatory Register		Final		Preparatory	
	Rams	Ewes	Rams	Ewes	Inspection	Presentation	Rams	Ewes	Rams	Ewes
Lincoln . . . . .	289	—	1 691	1 862	—	2 282	2 237	8 935	7 502	18 692
Merino Argentine . . . . .	—	—	596	555	—	—	1 007	2 377	—	3 384
Shropshire Down . . . . .	3	—	42	50	—	27	57	203	222	482
Oxford Down . . . . .	7	—	48	60	25	66	55	219	219	493
Romney Marsh . . . . .	13	—	20	20	—	200	49	86	1 128	1 263
Hampshire Down . . . . .	36	—	67	41	—	128	121	617	584	1 322
Border Leicester . . . . .	1	—	7	9	—	—	9	126	—	135
Corriedale . . . . .	—	—	—	—	—	—	1	—	50	51
<i>Totals.</i> . . . .	149	—	2 471	2 547	25	2 703	3 536	12 581	9 705	25 822

*Argentine Swine Book.*

Breeds	Entries between Oct. 1, 1915 and Sept. 30, 1916			Entries since foundation		
	Boars	Sows	Total	Boars	Sows	Totals
Berkshire. . . . .	958	1 421	2 379	4 220	5 285	9 505
Middle White Yorkshire . .	123	171	294	1 388	1 889	3 277
Large Black . . . . .	85	80	165	1 167	1 278	2 445
Poland China . . . . .	23	43	66	109	136	245
Tamworth . . . . .	50	64	104	85	142	227
Large White . . . . .	—	—	—	43	67	110
Duroc Jersey . . . . .	11	11	22	36	41	77
Lincolnshire. . . . .	—	—	—	—	1	—
<i>Totals. . .</i>	<i>1 240</i>	<i>1 790</i>	<i>3 030</i>	<i>7 048</i>	<i>8 839</i>	<i>15 887</i>

last year October 1, 1915 to September 30, 1916. They include all the pure-bred cattle, horses, sheep and pigs produced or imported into Argentina and show the yearly condition of the industry for breeding pure-bred animals in Argentina.

From these figures and those of the preceding year (1) the increase in numbers of the different pure-bred categories is seen to be as follows:

	Increase from October 1, 1915 to September, 30, 1916
Cattle . . . . .	11,253
Horses . . . . .	1,970
Sheep . . . . .	17,626
Pigs . . . . .	3,030

These increases are particularly due to cattle of the Shorthorn (8,811 head), Hereford (1,123 head) and Aberdeen Angus (1,184 head) breeds; to horses of the Percheron (656 head), Clydesdale (366 head), Hackney (365 head) and Shire (288 head) breeds; to Lincoln Sheep (18,692 head), Argentine Merinos (3,384), Oxford Down (1,263), Romney Marsh (1,322); to Berkshire pigs (2,379 head) and Middle White Yorkshire with 294 head. The four predominating pure breeds are Shorthorns among cows, Percherons among horses, Lincolns among sheep, and Berkshires among pigs.

## CATTLE.

265 - **Economics of the Breeding of Pure-Bred Stock.** — WENTWORTH, E. N., *The Field*. Vol. XXVI, No. 12, pp. 1009-1011. New York, December 1916.

Pure-bred stock represents the accumulated effort of generations of breeders leading to a well defined end, which may be expressed in profits already realised or in profits to be realised in the future. The price of pure-bred stock exceeds that of normal stock in view of the productive or reproductive capacity peculiar to each individual in relation to that of normal common individuals. This excess of value depends in its turn on various factors each of which represents the relative commercial value of a character exceeding those of the ordinary type on the market.

Careful observation of the markets shows that this increase is, roughly speaking, 15 to 20 % for reproductive power and more than 50 % for purity of blood combined with reproductive power.

The facts contained in the appended table, which refer to the maize-zone of the United States, whilst representing approximate averages, show this phenomenon much more clearly than could the valuation of profits on pure-bred stock which have either been already realised or remain to be realised in the future.

	Pigs (about 133 kg.)	Beef Animals	Sheep	Agricultural Mares	Dairy Cows
Normal average market value . . . . .	\$ 27	\$ 90	\$ 7.50	\$ 225	\$ 150
Reproductive value . . .	\$ 32	\$ 110	\$ 9.00	\$ 260	\$ 150
Value of purity of blood	\$ 45	\$ 150	\$ 12.50	\$ 400	\$ 250

These relative prices naturally refer to animals of similar type and conformation. Reproductive power in dairy cows does not increase the normal average market value because this is based on milk production which is an inverse quality to reproductive power.

Reproductive power increases the value of an animal because it gives a higher profit on the market than does normal production.

The value of pure-bred animals, on the contrary, is based more on future than present profits. Given two reproducers of equal individual merit, the pure-bred reproducer has a much higher value because, as a rule, it represents a better guarantee for good progeny. Reproductive capacity includes two factors: 1) the power of transmitting good characteristics to the descendants with greater uniformity; 2) a less strong tendency to the appearance of negative characteristics in the descendants. Both these advantages are the result of selection based on the ascendants to eliminate negative qualities and to unify and improve positive qualities.

There are many possible methods of obtaining these results, but none of them have a positive value because the relative success gained depends



on the way in which the breeder makes use of them. They have the practical character of a weekly test of the control of milk production. Anyone attempting to deduct from this the exact production of the productive cycle of the cow would find many contradictions in its application.

If it is used for comparison between two or more individuals, better results may be obtained. Finally, when used to study the special qualities of an individual which cannot develop under normal conditions, the weekly test at high tension, so to speak, is a method which allows a fundamental study to be made of the latent or reserve energies of the individual in relation to its productive power, its capacity of transforming food-stuffs and its nervous organisation.

In the same way the application of indications of predominant character, of pedigree, of fancy points or of family lines, as measures of the capacity to transmit characteristics should only be taken into consideration in so far as these various elements are correctly interpreted. If they are used as relative and not as absolute measures, they express in part the degree of uniformity and of constancy to which the pure-bred animal is capable of transmitting its characteristics, but they are practical methods capable of giving results only when used by experienced breeders who can estimate the value of failure as well as that of success.

Thus the predominant character in hereditary transmission does not go beyond the specific characteristics peculiar to the masculine or feminine appearance.

The fancy points only constitute the trade mark of the race, and hereditary power is usually quite independent of characteristics of value. It cannot, therefore, be said that, because it transmits certain more or less insignificant traits characteristic of the race, it has any special degree of dominance.

Biologically, the progeny represent data of greater value although, from a practical point of view, there are also considerable differences in this respect.

To the intelligent breeder the pedigree is the most important consideration to be kept in mind. If there are animals whose excellence has been proved most closely related to the genealogical tree, and if they occur in both branches of the genealogy at the same time, the breeder may feel a certain sense of security with regard to the power of transmitting superior characteristics. The greater the number of descendants whose worth has been proved, the greater is the certainty with regard to dominance. With regard to valuable animals, the length of the pedigree is looked upon by breeders as an indication of marked powers of reproduction and selection. The length of the pedigree is an equally valuable criterion in the descendant and it is here that a pure-bred animal is superior to a grade animal. Each breeder could have actual data with regard to the power of

transmitting characters possessed by any given dam, but other breeders could have no knowledge of these qualities and, a few years later, all traces of its individual merits will have disappeared. The individual merits of an pedigree animal are actual data which pass into the annals of the race to which it belongs, data which are taken into account in the valuation of each lineal descendant, which represents a hereditary fraction of these merits. Admitting that the merits of the immediate ascendants of an animal of common stock improved by a pure-grade are known, and that a pure-grade animal has immediate ascendants of equal value, this latter will have over the improved animal the advantage of progenitors having a well-defined identity which will allow the collected efforts of many breeders to be utilised. The relative value of the pedigree and of individual merit is a problem which deserves special attention. In this respect it must be remembered that a pure-bred animal may become a scrub under the influence of two forces, each with a separate action; it may appear to be a failure because the good qualities have disappeared or have been lost in the hereditary transmission, or, more often, it may appear to be a failure because of insufficient development. If it is certain that this inferior animal belongs to the second class it should always be used for reproduction in preference to an animal chosen by crossing, even if this latter has certain superior individual qualities. If it belongs to the first class there is no likelihood that, for the breeder, it has a superior value to the other. In consideration of the difficulty of determining the reason for the inferiority of a pure-bred animal, it is, in practice, usually wise to refrain from excessive optimism.

Breeders of pure-breds are also often faced with the problem of selecting from individuals of high lineal descent but of secondary merit, and from those of less celebrated family or descent, but with marked individual merit. In such cases the choice must be subordinated to the aims of the breeder. If he wishes to sell his products to breeders or producers of improved animals he should choose animals of individual merit. If he wishes to develop his dairy herd for exhibition or competition purposes he should still give preference to individual merit. If, on the other hand, he wishes to become a professional breeder of pure-bred stock, according to more distant, or even more difficult, schemes, he cannot ignore celebrated pure-breds, especially if he intends to sell his products to breeders working for the same end. In this case, whilst considering individual merits, even the best individuals will be sold at a lower price than animals belonging to celebrated families of pure-breds.

The profits from the breeding of pure-bred stock are closely connected with the fact that it is a sort of nursery in which the original seed reproduces itself with an identical aim. It can, therefore, not be compared with ordinary breeding.

The breeding of pure-bred stock in the United States only includes from 2 to 4 % of the total of the various zootechnical categories; by reason of its nature it must progress slowly. This is due to the fact that this branch of animal production is relatively new, and that, in the past, it was limited to breeders and agriculturists to whom the cost of pure-bred reproducers was a matter of secondary importance.

Since pure-bred stock are considered, so to speak, only as breeding animals, they command a price on the market which is unknown to ordinary or improved stock. It is in these prices that lie the market profits, which, when finally analysed, represent the capacity of transmitting economical characteristics to the progeny. This capacity cannot be recognised, however thoroughly it may be studied, even after 2 or 3 years of reproductive tests. The breeder of pure-breds who studies the indication which he believes to be connected with hereditary power and who acts on these indications is assured of profits which cannot be realised in ordinary animal-production for general market purposes.

266 - **A Cattle Reserve in Nigeria.** — CANNING, A. R., in *United Empire, The Royal Colonial Institute Journal*, Vol. VIII (New Series) No. 4, pp. 40-41, London, January 1917.

SERICULTURE.

The writer states that immense cattle reserves, 5 million head, exist in Nigeria. The animals could doubtless be easily purchased in the Bornu provinces, whence they could be driven down to Kano and transported by rail to Lagos. From Lagos, the frozen carcasses might be shipped for Europe. The quality of the beef is said to be, in some cases, quite equal to the British product. The writer advises that the herds of cattle for slaughter should be collected at a fixed date, that the animals should be examined by veterinary surgeons in Bornu, and rested and fattened in a reserve area near the railway, and that a large refrigerator should be put up at Lagos. A small refrigerator capable of handling some 24 carcasses already exists there. The utilisation of this enormous reserve of cattle would be greatly facilitated if the work were carried out under Government control.

267 - **Studies made by the Imperial Sericultural Station of Japan.** — *The Bulletin of the Imperial Sericultural Experiment Station Japan*, Vol. I, No. 1, 149 pp., + 2 Coloured Plates. Tokio, May 1916.

The bulletin analysed contains the following articles:

1. ETSUO KATAYAMA, Researches into the Nitrogenous Compounds in Mulberry leaves.
2. ROKUSABURO KUDO, Contributions to the Study of Parasitic Protozoa: I On the Structure and Life History of *Nosema bombycis* Nägeli.
3. KAORU AOKI, Precipitation Experiments with the Immune-serum of Silkworms.



4. KAORU AOKI, and YOSHIKA CHIGASAKI, On the Possibility of Applying the Agglutination Reaction in the Bacteriological Examination of Silk-worms. For the further Elucidation of the Question of the Identity of *Bacillus sotto* (Ishiwata), *B. alvei* (Cheshire and Cheyne) and *B. megatherium*.

5. KAORU AOKI and YOSHIKA CHIGASAKI, On the Virulence of the So-Called *Bacilli sotto* (Ishiwata) in Silk-worms.

6. KAORU AOKI and YOSHIKA CHIGASAKI, On the *Bacillus sotto* which des not produce Toxic Substances.

Mr. E. KATAYAMA has established the presence of the following substances in mulberry leaves.

Nitrogenous Compounds	Amount of substances obtained from 1 kg of leaves dried in sun still containing 12.32 per cent of residual water)		Amount of substances obtained from 100 gr. of albuminoids
	in free state	obtained by complete hydrolysis	
Glycocoll . . . . .	0.06 g	1.50 g	0.90 g
Alanine . . . . .	1.00	19.00	11.00
Valine . . . . .	0.47	10.50	5.60
Leucine . . . . .	0.60	21.00	8.00
Proline . . . . .	0.65	2.50	1.40
Serine . . . . .	—	2.00	0.80
Asparaginic acid . . . . .	5.20	6.00	2.40
Phenylalanine . . . . .	0.60	2.50	2.30
Tyrosine . . . . .	present	—	0.90
Guanine . . . . .	0.10	—	—
Adenine . . . . .	0.52	—	—
Hyperoxanthin . . . . .	0.12	—	—
Histidine . . . . .	0.20	1.30	0.96
Arginine . . . . .	1.30	8.80	1.20
Lysine . . . . .	0.93	6.60	1.70
Choline . . . . .	1.93	2.50	—
Trigonelline . . . . .	0.20	—	—

In the 3rd. of the studies mentioned above, Mr. K. AOKI has applied the method of precipitation with immune-serum to the study of the degree of relationship between the silk-worm (*Bombyx mori*) and the kindred species, *B. Mandarinana*, *Antheraea Pernyi*, *A. Yamamai*, *Caligula japonica*, *Dendrolimus Pini*, *Lymantria dispar*, *Diacrisia anino* and *Papilio xuthus*. He further studies the manner in which the precipitate varies with the different stages in the development of *Bombyx mori*, from the egg to the moth and investigated the precipitation reaction in the silk glands and other organs. From the total results obtained, he drew the following conclusions amongst others.

1. By means of the reciprocal precipitation of different species of

animals, the degree of their affinity can be accurately determined, and therefore their position in the zoological scale.

2. The amount of an immune-serum precipitate is not always equal when the serum of the same species of animal is used, if the serum comes from larvae in their 2nd, 3rd, or 4th, stage of deveopment. In these cases, the precipitate is much less than that obtained from the serum of adult individuals or from the liquid expressed from the eggs. The latter substance gives the heaviest precipitate.

3) An undoubted specific organic reaction has been found in the silk glands of *B. Mori*.

4) No difference was observed in the precipitate of the serums of the two sexes in the presence of the two kinds of sexual glands belonging to *B. Mori*.

In the 4th article, Messrs. K. Aoki and Y. Chigasaki show that:

1. The agglutination reaction in the case of the *sotto bacillus* is strictly specific.

2. By means of this immune-reaction, *Bacillus sotto* (Ishiwata) can easily be distinguished from *B. megatherium* and *B. alvei*, thus the question of their identity has been solved in the negative.

In the 5th article, the same writers show that when the silkworms were fed on a young culture of *sotto* bacilli, the microorganism perished and the larvae were not killed, when however, the silkworms were given an old culture of the same bacilli, they were killed in 3 hours. In fatal cases, the microorganisms do not multiply in the intestinal canal, but only in the haemo-lymphatic system, where they cause septicemia and sapremia. The toxic substance is present in the bacterial colonies whence it can be partially removed by shaking it in a solution of sodium chloride; it does not pass through a Chamberlain filter.

Different disinfectants act in different ways on *Bacilli sotto* and the toxic substance they produce.

In the 6th. paper, the same writers describe a race of *sotto* bacilli discovered by themselves, which is not able to produce fatal effects if it is cultivated in agar, though it retains its property of causing septicemia. This atoxigenous race cannot be distinguished from the normal toxigenous races, either by cultural means, or by the use of immune-serums.

## FARM ENGINEERING.

268 - **Exhibition and Trial of New Agricultural Machinery and Appliances organised by the German Agricultural Society in 1916.** - FISCHER, G., in *Mitteilungen der Deutschen Landwirtschafts-Gesellschafts*. Vol. 45, pp. 730-733. Berlin, November 4, 1916.

AGRICULTURAL  
MACHINES  
AND  
IMPLEMENTS

In 1916, on the occasion of the "Landwirtschaftliche Woche" (agricultural week) the German agricultural society organised an exhibition

and trial of new agricultural machines and implements (excluding dairy machinery, etc.), in order to give the manufacturers a chance of submitting improvements to the Society in spite of the present crisis and to introduce them to the agricultural public.

There were 64 machines and types of apparatus entered, and the exhibition was well patronised. Of these machines, etc., 5 (*i. e.* 7.8 % of the entries) were judged as "new and worthy of attention" ("neu und beachtenswert"), 42 (65.6 %) were reserved for trials, and 16 (25 %) were not considered worthy of mention. In comparison with the exhibitions of previous years, there were less entries, but there were more trials.

The following machines were considered to be "new and worthy of attention".

1) *Portable membrane pump* K 14 by the BERLINER PUMPENFABRIK, AKTIENGESSELLSCHAFT VORMALS MAX BRANDENBURG, Berlin. S. O. — Between the upper and open end of the pump and its lower, closed end is a plate-shaped membrane of stretched leather, which is alternately pushed up and down by means of a bent lever and a connecting rod controlled by the pump-handle. To the left is the suction pipe and on the right is the valved supply pipe. The pump is mounted on a wooden base, provided with hollows for carrying; the operator stands on the wooden base while pumping to increase the stability. The pump delivers nearly 1000 gallons per hour to a small height, weighs 57 lbs and costs 100 marks (about £ 5) including flexible suction and supply tubes.

2) "*Hannibal Ante portas Pump*", 1915 model, by P. C. WINTERHOFF of Düsseldorf. — This pump, already described in previous reports of the German Agricultural Society, has been improved by adding new valve-seatings under German patent No. 270 152. On the rubber ring used as a seating a bar presses carrying a pointed spur that prevents the ring being moved by pressure from below upwards. These valve seatings have been placed in both suction and delivery pipes. The pump, mounted on a wood base and thus easy to remove, weighs about 88 lbs; obtaining water at 23 feet and delivering it at 33 feet, it delivers 2200 galls. per minute. The price of 150 marks (£ 7-10-0) includes flexible tubes for suction and delivery.

3) *Mower with a foot-lever for raising the knife-bar*, by the "MASCHINENFABRIK FAHR, A. G.", at Gottmadigen, Baden. — By twice depressing a lever with the right foot, when the machine is either stationary or working, the driver can lift the knife-bar into a vertical position without using his hand; by depressing the lever *once*, the knife-bar can be lifted to the usual height, *i. e.* above small obstacles; in this position the bar is held by a catch, and when the lever is depressed the second time the bar is brought into a vertical position. By means of catches holding it



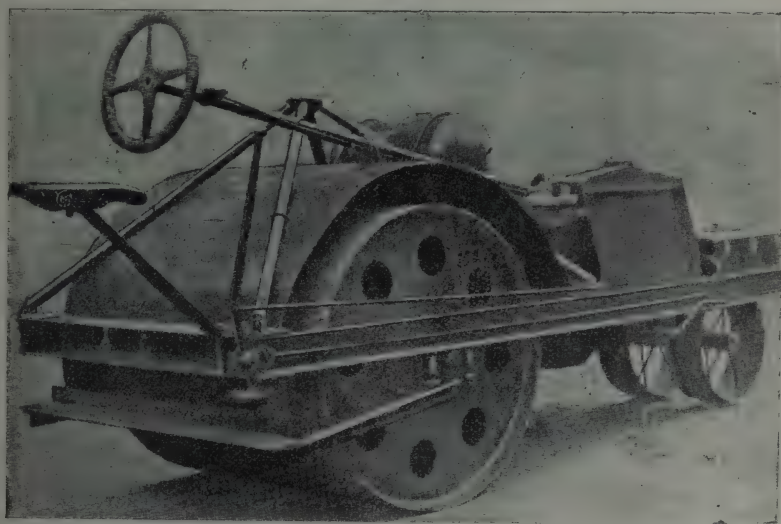
in position with regard to the 2-armed lifting-lever the foot-lever is equally available at the second depression as at the first. To lower the knife-bar, another foot-lever is used. Such a machine works on a breadth of 4 ft. 6 ins., weighs 748 lbs and costs 345 marks (£ 17-5-0).

4) *The "Wilhelma" grinding and crushing mill*, by the "FULDAER MASCHINEN- UND WERKZEUGFABRIK WILHELM HARTMANN", of Fulda, Hesse-Nassau. — Mill with artificial, vertical stones, 72 ft 6 ins in diameter, mounted on a horizontal axis with 3 bearings. The mechanism for regulating the fineness of milling is close by the outlet, within reach of the operator. The shaking mechanism has a good control system which prevents useless work. The mill requires a driving force of 8 to 12 H. P. and produces 1760 to 5280 lbs per hour; it cost 950 marks (£ 47-10-0).

5) *"Rheinland" cylinder mill*, by the "MASCHINENFABRIK W. LEY", of Wülfrath, Rhenish Prussia. — The characteristic of this mill is that the gear between the cylinders is freed by pulling out a bolt, which easily allows the two cylinders to be given the same speed. The mill weighs 1100 lbs and grinds 1760 lbs of cereal per hour, using 5 to 7.5 HP: it costs 760 marks (£ 38).

269 - **Whiting Standard Agricultural Tractor.** — *The Implement and Machinery Review*, Vol. 42, No. 501, p. 1020, 1 fig. London, January 1, 1917.

Messrs. WHITING (1915), Ltd., 334-340, Euston Road, London, N. W. are placing the Whiting Standard Tractor upon the English market. This



Whiting Standard Agricultural Tractor.

is of 24 h. p., and has a four-cylinder  $3\frac{3}{4}$  in. by 5 in. engine which runs on petrol. The transmission is by chain which runs between the two drive wheels in the rear, each being 45 in. in diameter and 24 in. wide. The total length of the tractor is 14 ft. 6 in. and its width 6 ft. 2 in.

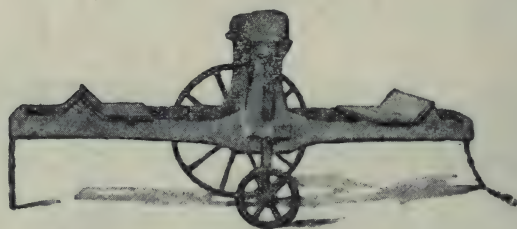
All the working parts of the engine are enclosed so as to be free from dust; only one hand lever is used in ordinary work; and there is no differential, the drive on the wheels being direct and positive. It is claimed that this tractor will turn in a 30 ft. circle, and that it will turn as easily and smoothly on freshly ploughed land as on dry soil.

Demonstrations of this tractor are now being arranged.

270 - **Trailer for Men who have lost a Leg.** — MAURIN, G., in *Journal d'Agriculture pratique*, Year 80, No. 26, pp. 455-456 + 1 Fig, Paris, December 28, 1916.

Dr. ALBERT MARTIN of Rouen (France) invented this trailer, only weighing from 88 to 100 lbs, in order to enable men having lost a leg to work with a double plough without tiring themselves too much.

The apparatus, which consists of a wheel chair for the disabled man, is attached behind the plough and at the end of each furrow the man



Dr MARTIN's trailer.

gets out of the chair, detaches it from the plough, then turns and places the double plough in position; then he again attaches the drag on which he sits until the other end of the furrow is reached.

The drag is made of wood and is built symmetrically so as permit its use in either direction. In the middle, under the seat, the drag is supported by a large furrow wheel and by a small land wheel, which latter can be adjusted in respect to the large wheel and according to the furrow-depth. For this purpose the axle of the small wheel carries an upright pierced with holes; a bolt holds the wheel in the desired position.

271 - **Improved Apparatus for Determining the Test Weight of Grain, with a Standard Method of Making the Test.** — BOERNER, E. G. in *U. S. Department of Agriculture, Bulletin No. 472*, 15 pp., 8 figs. Washington, D. C., October 30, 1916.

The improved testing apparatus for obtaining the weight per bushel described in this bulletin was designed to reduce to a minimum the personal error in making the test and to standardize the method of determining the test weight of grain.

**DESCRIPTION OF THE DEVICE.** — The apparatus (fig. 1) is in two main parts: 1) The stand, with hopper and overflow pan, and 2) test kettle, with a special beam. The base of the stand is made up of two layers of wood held together with screws. Each layer is  $1\frac{1}{2}$  inches thick, the upper layer projecting  $\frac{1}{4}$  inch over the lower layer around the edges, so that the base can be conveniently fastened into a table top if desired. In the forward part of the base is contained a circular opening with bevelled edges, of the shape and size shown in figure 2. A grate made of four metal bars fastened into the lower layer of the base extends across the opening in the base, as shown in figure 3. A circular metal disk, or plate, upon which the test kettle rests when in place, is clamped on the upper side of the grating in such a position that the centre of the plate coincides with the centre of the opening in the base. Two metal guide pins, about 3 inches apart, are fastened to the edge of the plate and then extended upward about half an inch higher than the surface of the plate. These guide pins are placed here to centre the quart test kettle when it is in place on the plate. The two guide pins are connected by a strip of metal of the size and shape illustrated in figures 2 and 3. This strip of metal is free-swinging, and when swung over on the plate forms a guide for centring the pint test kettle.

Fitted into metal sockets sunk into the after part of the base are two tubular metal posts 19 inches long and connected with a casting at their upper ends. Fitted to the forward or main post are two free-swinging metal brackets or arms, the lower one of which terminates in a ring  $7\frac{1}{4}$  inches in diameter to hold the hopper, the upper arm terminating in a hook from which the scalebeam can be suspended. The arms are held in place at any given height on the post by means of two metal clamps, as shown in figure 2.

Each of these arms has a projection extending backward past the rear or guide post, so arranged that when the ring of the lower arm and the hook of the upper arm are swung to a position directly over the plate in the base these projections are in contact with the guide post. The projection on the lower arm allows the arm with funnel to swing to the left, while the projection on the upper arm allows this arm with its scalebeam to swing to the right.



The base of the stand rests on three adjustable metal legs which fit into metal sockets sunk into the under side of the base, in the positions

*Apparatus for Determining the Test Weight  
of Grain*

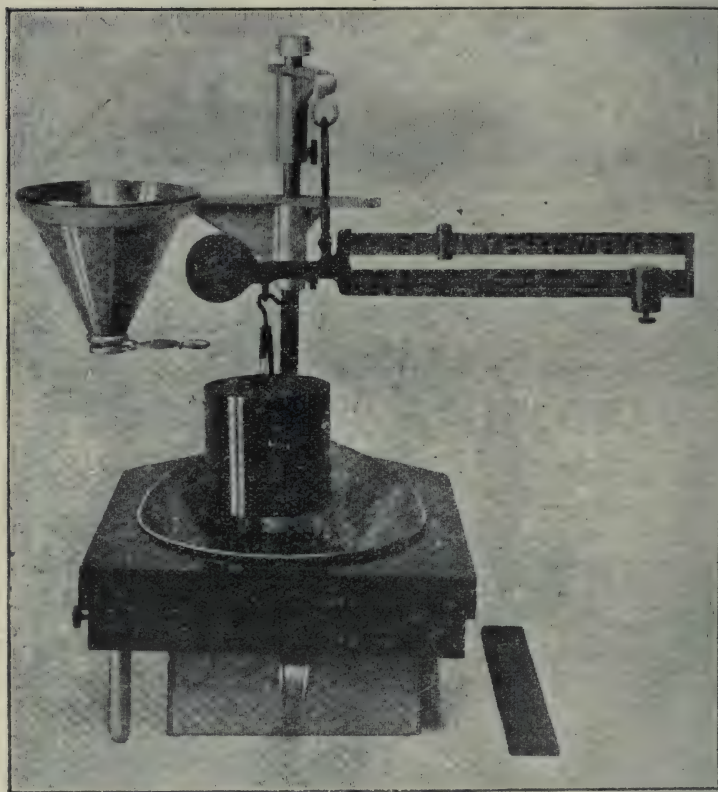


Fig. 1. — Front view of apparatus.

shown in figure 3. The legs are held in place by means of set screws. A pan for catching the overflow from the test kettle is placed underneath the grating.

*Apparatus for Determining the Test Weight  
of Grain.*

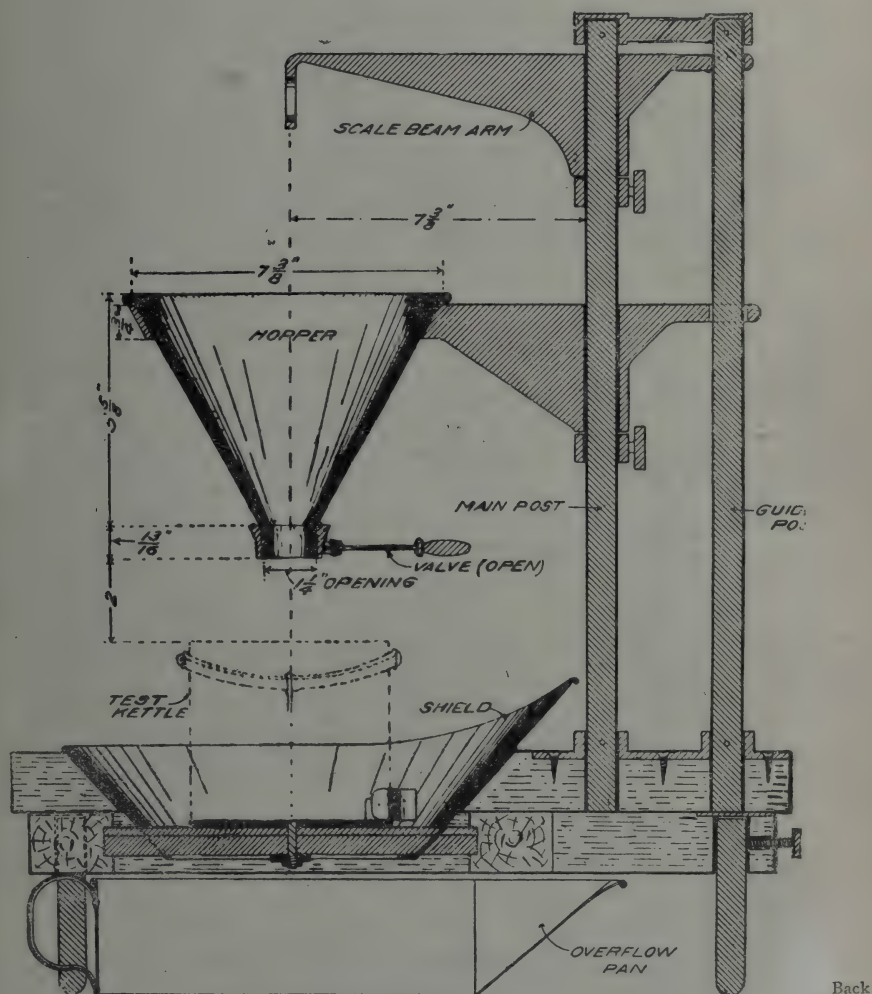


Fig. 2. — Vertical section.

*Apparatus for Determining the Test Weight  
of Grain.*

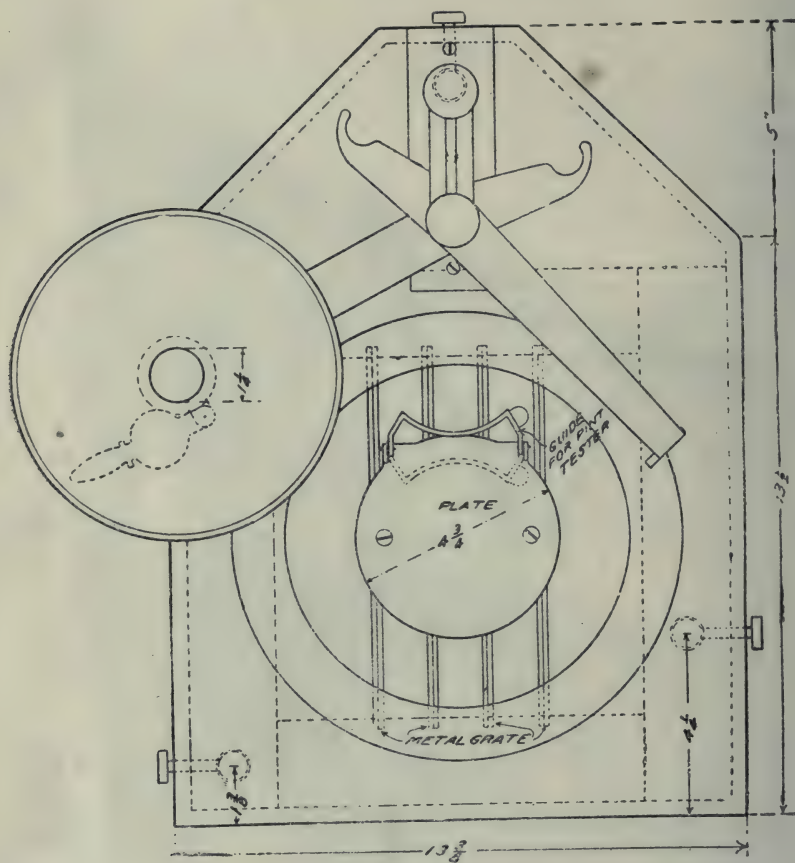


Fig. 3. — Schematic horizontal projection  
of the apparatus showing arrangement  
of grate, disk and guide.



The hopper, which rests in the ring of the lower arm, is large enough to hold more than a quart of grain and should be of the shape and size shown in figure 2. A valve at its lower opening holds the grain in the hopper until ready, to make the test. The opening, or outlet, in the bottom of the hopper is  $1\frac{1}{4}$  inches in diameter.

The special stroker is of hard wood,  $\frac{3}{8}$  inch thick,  $1\frac{3}{4}$  inches broad, and 12 inches long, each edge being a perfect half circle. This stroker should be used for all tests.

The stand can be used with either the ordinary test kettle and beam or with the test kettle and special combination beam.

The special beam, graduated to read in tenths of a pound, was devised in order to make it possible to obtain reliable results reading in fractions of a pound. This special beam has two bars, one above the other, each of which has three lines of graduations. The first line on the lower bar reads in pounds per bushel, in divisions of 10 pounds up to 60 pounds; the second line reads in pounds and ounces by one-half ounce division up to 2 pounds dead weight, and is used principally for determining "dockage" in grain; the third line reads in percentage of 2 pounds by 1 per cent divisions up to 100 per cent.

The first line of graduations on the upper bar reads in pounds and tenths of a pound up to 10 pounds per bushel, the second line reads in grams by 2 gram divisions up to 200 grams dead weight; and the third line reads in percentage of 200 grams by 1 per cent divisions up to 100 per cent. These last two lines of graduations will be found especially useful in the analysis of corn to determine what it should grade from the standpoint of damaged kernels or of foreign matter and finely broken corn.

The poise on the lower bar is supplied with a set screw, so that it can be moved to any one of the 10 pound graduations and clamped in position to keep it from shifting while repeated weighings are being made on the upper beam.

OPERATING THE TESTER. — Place the tester on a solid table top or other firm base. Adjust the height of the funnel arm so that the opening in the bottom of the funnel is exactly 2 inches above the top of the test kettle. Place the test kettle on the metal plate over the grate and see that the overflow pan is in place under the grate opening. Swing the hopper arm into forward position until the projection extending backward is in contact with the guidepost. Close the valve in the outlet from the hopper and fill the hopper with the grain or seed to be tested. Open the valve wide with a quick motion and allow the grain to run through until the kettle overflows. Swing the hopper arm out of the way to the left. Strike the excess grain from the top of the test kettle with three zigzag motions of the special stroker, being careful that the sides of the stroker

are held in a vertical position and that the kettle is not jarred during the operation. Bring the beam arm with beam suspended into its forward position. After hooking the test kettle to the short arm of the special scalebeam, the poise on the lower beam must be placed at one of the graduations showing a weight lower than the sample is expected to weigh and the operation is completed by moving the poise on the upper bar to a point necessary to make the beam balance.

If the ordinary beam is used instead of the special beam, then the weighing should be done in the usual manner, except that the beam should be suspended from the hook of the upper arm instead of being held by hand.

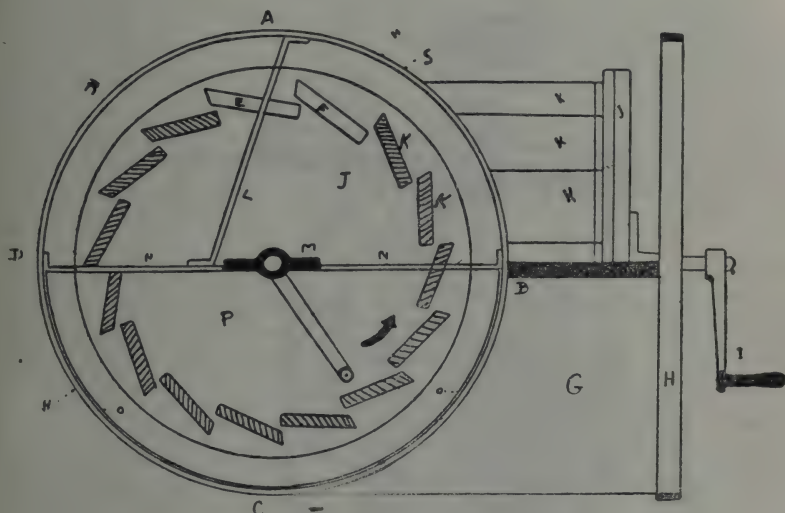
**STANDARD METHOD OF MAKING THE TEST.** — The conditions given in the method described below have been found to be most essential in making uniform tests of weight per bushel and obtaining accurate results and have been adopted by the U. S. Department of Agriculture, as standard in connection with Grain Standardization Investigations:

- 1) Have an accurate grain tester.
- 2) Fill the test kettle from a hopper:
  - a) having an opening  $1\frac{1}{4}$  inches in diameter at its base.
  - b) firmly supported 2 inches above the test kettle.
- 3) Have the test kettle rest on a firm base.
- 4) Fill the kettle each time with the same amount of overflow.
- 5) Strike the excess grain from the top of the overflowing kettle in a uniform manner with three zigzag motions with sides of the special stoker held vertically, avoiding meanwhile any jarring of the contents.
- 6) Make the weighings on a beam accurately graduated to read in fractions of a pound.

272 - **The "Cataract,, Root Washer and Peeler.** — *The Implement and Machinery Review*, Vol. 42, No. 501, p. 1014, 1 fig. London, January 1, 1917.

A new machine for washing potatoes, carrots, beet, parsnips and all kinds of medicinal roots has been brought out by the British Fruit Evaporator Company, Ridsdale-rd., Anerley, London, S. E. This is shown in the accompanying diagram, which is an end section and a part longitudinal view of the machine. *ABC* and *D* show one of the two ends of the tank, forging a circular frame into which the tank *G* is built. Across the centre runs a bearing rail *N* carrying the bearing *M* and the barrel spindle. *L* is a strengthening rail and *P* is the end of the tank. *J* is the disc of one end of the barrel, of which *K K K* are three of the slats. *F* and *E* are the slats which open to enable the roots to be placed in and emptied from the barrel. The method of operation is as follows: The tank is sufficiently filled with water from a tap or other source, and the roots are placed in the barrel through the *EF* slat opening, which is then closed. The handle is rotated in the direction of the arrow, and when the roots are cleaned

the whole tank is rolled a quarter turn, by which movement point *B* is brought lowermost and the water is immediately emptied from the tank. A further quarter turn empties the tank of roots by gravity, whilst a half-turn brings it back again to filling position. The machine requires no



"Cataract," Root washer and peeler.

stand, and can be rolled from place to place, on the rims *H*, just like an ordinary barrel. The water is drawn into the barrel in streams during rotation, instead of being expelled by centrifugal action, and this, the makers claim, enables roots to be cleaned in less than half the time occupied by other methods. By placing perforated metal strips on the slats of the barrel, the machine becomes an abrasive potato and root peeler.

For dealing with large quantities of roots a power machine is made.

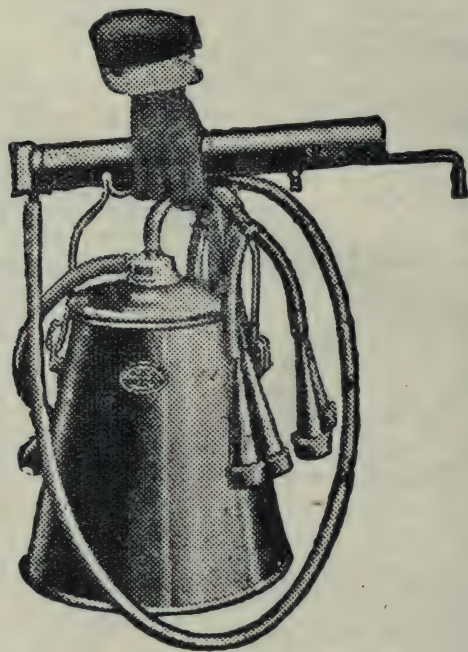
273 - **Hinman Mechanical Milkers.** — *Farm Implement News*, Vol. XXXVII, No. 49, pp. 30-31, 1 fig. Chicago, Ill., December 7, 1916.

Following the idea that a simple milking machine could be made tight enough to exclude all outside contamination without using a vacuum in the pail and still insure purer and more sanitary milk, the inventors, HINMAN, father and son, have built a milking machine of extreme simplicity.

The Hinman milker has no pulsating mechanism, no air pipe lines, no vacuum tanks. It is just a simple combination of pump, vacuum in valve chamber in pail cover, and natural pressure in teat cups. The



pump is a simple one piece type, operating at slow speed with long stroke, producing the exact amount of vacuum required with no possibility of too much pressure. The vacuum is in the valve chamber in the pail cover. This chamber has but one moving part. The weight of milk opens the valve or disk when suction is stopped. This regular action also helps



Single-unit HINMANN Milker.

the natural action in teat cups so that the circulation of blood in the teats is normal. The teat cup is not a rubber sack, but simply a pure rubber ring slipped over a metal cup. It is natural and gentle in action and more uniform than the human hand.

This machine is constructed by the "Hinmann Milking Machine Co.", Dept. 2, Oneida, N. Y.

**274 - Test of Mechanical Cultivators in the Department of the Indre, France.**

— DISSOUBRAY, J., in *La Vie agricole et rurale*, Year 6, No. 53, pp. 482-484. Paris, December 30, 1916.

Public trials of tractors were organised from September 18 to 25, 1916, by the Breeders' and Agricultural Societies of the Department of the Indre. The four localities of Issoudum, Vatan, Levroux and Buzançais were chosen.

The bad weather and unsuitable state of the ground did not allow the trials at Vatan to be well carried out. The general results of the trials are as follows:

MACHINES HAVING TAKEN PART IN THE TRIALS:

- 1) EMERSON tractor, 10-20 HP, carrying a 3-furrow plough, lifting automatically and with circular coulters.
- 2) *Bull* tractor, 8-16 HP, with 2-body gang-plough, lifting automatically and with circular coulters.
- 3) Two *Mogul* tractors, 8-16 HP, one with a 2-body plough, the other 3-body; both lifting automatically and with circular coulters.
- 4) *Titan* tractor, 15-20 HP, with a 4-body plough, lifting automatically and with circular coulters.
- 5) CASE tractor, 12-15 HP, with a 4-body plough, lifting automatically and with circular coulters.

The CASE tractor only took part in the Vatan and Levroux trials; the *Titan* tractor only took part in the Vatan and Buzançais trials; the *Mogul* tractor No. 2, only took part in the Levroux and Buzançais trials.

*Issoudun (Villaine Farm).* — The field, which had carried potatoes and beets in 1915, had not been cultivated for a year; the soil was covered with weeds, but not so much as to form a turf. The soil is a stony limey-clay, a pronounced type of the so-called "Grouaille" soil; at some points, rock is near the surface and cultivation never goes deeper than 4 to 5 inches.

*Levroux (Marmagne Farm).* — Old oat stubble with patches of brambles whose spreading stems covered the soil; the soil is practically level and the furrows are about 650 yards long. The soil is a sandy clay, of the soft soil called "Beauce" in a most favourable condition of humidity for working.

*Buzançais (Brosse Farm).* — The field, recently under crimson clover sown down on wheat stubble, had not been worked since the autumn of 1914. As it was to be sown with wheat, it had been dressed with well-rotted manure which clogged the tractor-wheels and decreased their adherence. The soil was rather dry. The field was irregular and in some parts the furrows varied from 170 to 218 yards in length. The soil was like that of Villaine ("Grouaille" soil), calcareous clay, but with fewer large stones and the rock further away from the surface; the soil had been broken up some 12 years before, when sugar-beet was grown.

The general results of the trials are shown in Tables I and II. The cost of fuel per acre was based on the prices of 2 s. 7  $\frac{1}{2}$  d. per gallon of petrol and 1 s. 6  $\frac{3}{4}$  d. per gallon of paraffin.

TABLE I. — *Cubic content of earth stirred, consumption of fuel and cost price of labour per acre.*

Tractors	Earth moved in cu. ft.			Fuel, in galls.			Cost per acre in £ s. d.		
	Issoudun	Levroux	Buzançais	Issoudun	Levroux	Buzançais	Issoudun	Levroux	Buzançais
<i>Bull.</i> . . . . .	42 380	60 034	49 444	8. 8	8. 36	9. 48	9s. 7d.	9s. 2d.	10s. 7d.
<i>CASE</i> . . . . .	—	60 034	—	—	5. 89	—	—	—	—
<i>EMERSON.</i> . . . .	42 380	1 250	60 034	8. 02	7. 44	9. 02	9s. 9d.	9s. 0d.	9s. 9d.
<i>Mogul No. 1</i> . . .	56 507	60 034	56 507	13. 2 Paraffin	12. 91	15. 07 Paraffin	8s. 8d.	8s. 2d.	9s. 8d.
<i>Mogul No. 2</i> . . .	—	56 507	45 912	—	8. 55	11. 74 Paraffin	—	14s. 1. 5d.	7s. 9d.
<i>Titan !</i> . . . . .	—	—	56 507	—	—	10. 72	—	13s. 3d.	11s. 8d.

TABLE II. — *Cost of Petrol or Paraffin for 1 acre cultivated to a depth of 5 inches.*

Tractors	Galls used, per acre			Cost of fuel		
	Issoudun	Levroux	Buzançais	Issoudun	Levroux	Buzançais
<i>Bull</i> . . . . .	3. 56	2. 39	3. 36	9s. 7. 5d.	8s. 4. 5d.	9s. 1d.
<i>CASE</i> . . . . .	—	1. 68	—	—	4s. 6. 5d.	—
<i>EMERSON</i> . . . . .	3. 24	2. 89	4. 1	8s. 9d.	7s. 10d.	12s. 0d.
<i>Mogul No. 1</i> . . .	4. 008 Paraffin	3. 69	4. 58 Paraffin	6s. 6d.	10s. 0d.	7s. 5. 5d.
<i>Mogul No. 2</i> . . .	—	2. 33	4. 39 Paraffin	—	6s. 3d.	7s. 1. 5d.
<i>Titan.</i> . . . . .	—	—	3. 25	—	—	8s. 9d.

## 275 — Review of Patents.

*Tillage Machines and Implements.*

Austria	72 438	Device for regulating the height of the plough-body in a motor plough.
	72 545	Disc harrow.
	72 903	Cultivator.
	72 908	Harrow.



- France 481 344 Vine cultivator.  
 481 538 Implement for cultivating between the rows of vines.  
 481 813 Motorplough adaptable to various kinds of work.
- Germany 294 157 Tillage Implement with an implement frame carried by arms  
 oscillating laterally.  
 294 408 Motor plough with a driving-wheel placed in a movable  
 frame in front of the machine.  
 294 744 Motor plough with the chassis for the plough-bodies attached  
 by an articulated parallelogram.
- Switzerland 74 412 Motor-plough.
- United Kingdom 13 661 Harrow.  
 13 779 Motor-plough.  
 102 376 Gang-plough.
- United States 1 204 422 Cultivator or Harrow.  
 1 204 566 — 1 207 433 Plough attachment.  
 1 204 603 Depth-equalising shovel-beam attachment for cultivators.  
 1 204 828 — 1 207 640 — 1 207 686 — 1 209 368 — 1 209 898 —  
 1 210 249 — 1 210 338 — 12 210 350 Ploughs.  
 1 206 517 Back-to back-plough.  
 1 206 945 Tillage Implement.  
 1 207 310 Rotary plough.  
 1 207 430 Plough-lift.  
 1 207 539 — 1 208 856 Motor-ploughs.  
 1 207 579 Rotary harrow.  
 1 207 984 Combination farming-machine.  
 1 208 380 Method for attaching ploughs.  
 1 208 434 Adjustable riding-cultivator frame.  
 1 208 599 Leveller and pulveriser.  
 1 208 856 Motor-driven tilling machine.  
 1 209 066 Maize plough.  
 1 209 072 Combined garden-weeder and pulveriser.  
 1 209 467 Roller attachment for listers.  
 1 209 543 Land-marker.  
 1 209 565 Harrow.  
 1 209 897 Steam-plough.  
 1 210 092 Weeder.

*Drainage and Irrigation.*

- Austria 72 431 Watering apparatus.
- Germany 294 289 Automatic waterer for gardens.  
 294 457 Digger with oscillating forks.
- United Kingdom 13 221 Spraying machine for water and other liquids.

*Manures and Manure Distributors.*

- Austria 72 905 — 72 909 — 73 016 Manure distributors.
- Denmark 21 758 Manure distributor.

- Germany 294 352 Manure spreader with mixing drum.  
 295 260 Machine for spreading farm-yard manure.
- Switzerland 74 340 Method of preparing peat for use as a manure.
- United Kingdom 14 487 Methods of producing fertilisers by acting on peat: a) with ammonia and calcium carbonate; b) with ammonium sulphate and an alkali.
- United States I 207 000 — I 207 086 Manure spreaders.  
 I 209 092 Fertiliser spreader.  
 I 209 532 Straw and manure spreader.

*Drills and Sowing Machines, etc.*

- Austria 72 432 Potato-planter.  
 72 550 Drill for any kind of seed.  
 72 551 Drill with regulator for the seed sown.  
 72 692 Drill, specially for gardens, with coulters that can be moved to one side.
- France 481 837 Machine for singling and hoeing vegetables planted in lines.
- Germany 294 288 Potato-planter with bucket-wheel.  
 294 970 Potato-planter.
- United Kingdom 12 860 Lawn-mowers.
- United States I 204 840 Maize-cultivator,  
 I 207 094 — I 207 445 Cotton-cultivators.  
 I 207 473 Maize-planter harrow.  
 I 207 557 Marker for maize-planters.  
 I 207 890 Maize-planter.  
 I 208 514 Machine for removing surplus plants.  
 I 209 138 Potato-planter.  
 I 209 329 Seed-planter.  
 I 210 185 Sugar-beet cultivator attachment.

*Control of Diseases and Pests of Plants.*

- Austria 72 507 Method for preparing a dry antifungus remedy giving an emulsion of copper oxychloride with water.  
 72 715 Method for destroying clover dodder.  
 73 011 Carbon bisulphide injector.
- France 470 538 Sprayer or sulphater using a bicycle pump and valve (or of the same bore) as supply control; for agricultural use and for disinfecting premises.  
 481 703 New removable, non-choking, bung-valve for sprayers for sulphating vines.
- Germany 295 001 Balance-trap for gnawing animals.  
 295 261 Insecticide.
- United Kingdom 102 449 Weed destroyer.
- United States I 204 772 Weed cutter and sprayer.  
 I 209 072 Combined garden-weeder and pulveriser.

*Reapers, Mowers and Harvesting Machines.*

- |                |  |
|----------------|--|
| Austria        | 72 906 Combined reaper and thresher.   |
|                | 72 911 Reaper with 2 superimposed cutting-bars.  |
|                | 72 913 Reaper.   |
|                | 72 914 Binder and swathe former for reapers.   |
|                | 73 014 Adjustable hay-maker with combined drum and swathe-turner.  |
| Germany        | 294 354 Mower with two knives with a to-and-fro motion.  |
|                | 294 409 Protector for knife-beam of mower.   |
|                | 295 111 Mower with frame carrying the knife-beam, both of which can turn round a common axis in the longitudinal plane of the machine. |
| United Kingdom | 12 639 CARNE (1) hay-rake.   |
|                | 13 172 Flax-pulling Machines.  |
| United States  | 1 204 403 Grain-harvester and binder.  |
|                | 1 204 441 Grain-lifter for harvesters.   |
|                | 1 204 460 Hay-rake.  |
|                | 1 204 536 Harvester.   |
|                | 1 204 557 Harvesting machinery.  |
|                | 1 204 661 Hay-cocker.  |
|                | 1 208 591 Cotton-harvester.  |
|                | 1 209 519 Combination mower.   |
|                | 1 209 558 Mowing-machine.  |

*Machines for Lifting Root Crops.*

- |                |   |
|----------------|---|
| Austria        | 72 434 Turnip-topper.   |
|                | 72 542 Beet-harvesters.                                       |
|                | 72 546 Potatolifter with delivery wheel.                      |
|                | 72 547 — 73 013 Potato-lifters.                               |
| Denmark        | 21 317 Root-topping machine.                                  |
| Germany        | 294 357 Root-topping machine.                                 |
| United Kingdom | 13 741 Root-lifting machine.                                  |
|                | 13 786 Root-topping machine.                                  |
| United States  | 1 204 627 Beet-topper and digger.                             |
|                | 1 205 060 — 1 207 889 — 1 209 055 — 1 210 057 Beet-harvester. |
|                | 1 206 893 Peanut-digger.                                      |

*Threshing and Winnowing Machines.*

- |          |  |
|----------|--|
| Austria  | 72 433 Thresher.                       |
| Colombia | 1 250 Thresher.                        |
| Germany  | 294 410 Thresher.                      |
|          | 295 232 Straw-shaker for beater.       |
|          | 295 343 Oscillating shaker for beater. |



- United States    I 209 114 Seed-cotton cleaner.  
                      I 209 707 Straw carrier and grain-separator.

*Machines and Implements for the Preparation and Storage of Grain, Fodder, etc.*

- Germany            294 355 Apparatus for emptying barns.  
                      294 356 Straw elevator.  
                      294 919 Straw-chopper.  
                      294 943 Ungearing mechanism for chop-cutters.  
                      295 000 Machine with circular saws for cutting poppy-heads.  
                      295 055 Device for fastening ends of wires in baling-presses.  
                      295 085 Spurrey-cutter.  
                      295 210 Dust-aspirator for chop-cutters, etc. (1).  
                      295 366 Potato-sorting machine with oscillating suspended riddles.  
  
 United States    I 205 090 — I 208 466 Hay-press.  
                      I 207 189 Maize husking and shredding machine.  
                      I 207 578 Hay-stacker.  
                      I 208 988 Straw-stacker.  
                      I 209 873 Hood for pneumatic stackers.

*Forestry.*

- Austria            72 697 Tree-felling saw.  
 France            481 733 Method for felling and sawing up timber.  
 Germany          294 949 Method or apparatus for extracting the sap or resin from  
    tree stumps.

*Steering, etc. of agricultural machinery.*

- United States    I 204 516 Caterpillar tractor.  
                      I 206 895 — I 207 875 — I 208 062 — I 208 381 — I 208 657 —  
    I 209 906 — I 209 815 Tractors.  
                      I 207 335 Four-wheel drive for tractors.

*Feeding and Housing of Livestock.*

- Austria            73 078 Tying-up device for stables, etc.  
 Germany          294 458 — 294 674 Fixing horse-shoes.  
                      294 513 Fixing horse-shoes without nails.  
                      295 330 Claw-shoes for cracked heels.  
 United States    I 204 707 — I 207 096 — I 209 832 Pig-oilers.

*Aviculture.*

- Germany            294 360 Poultry-pen door.

(1) See *B*, February 1917, No. 180.

*Apiculture.*

- Austria 72 541 Tool for uncapping honeycombs.  
 Germany 294 361 Hive with more or less oval brood cells surrounded by honey receptacles.

*Fisheries.*

- France 481 734 Spring pivoting drum for casting for fishing.  
 Germany 294 362 Eel-net.  
 294 363 Drag-net.  
 295 316 Artificial bait.

*Farm Buildings.*

- Austria 72 699 Shippon with device for bringing and distributing litter and food.  
 Germany 294 832 Stable fittings.  
 294 944 Hot-bed covering with device for the simultaneous opening of a large number.  
 294 954 Winter-covering for hot-beds, etc.

*Dairying.*

- Germany 295 056 Teat-cup for milking machine  
 295 344 Centrifugal separator with churn.  
 Switzerland 74 325 Butter-making machine.  
 74 326 Apparatus for killing injurious germs in milk, etc.  
 74 327 Hygienic receptacle for boiling milk.  
 United Kingdom 13 308 — 102 333 Churns.  
 102 204 Milk-can.  
 102 453 Method for preserving Cheddar cheese.  
 United States 1 210 304 Milking machine.

*Various.*

- France 481 874 Shoe-protector for use with shovels.

## RURAL ECONOMICS.

276 - **The Normal Day's Work of Farm Implements, Workmen, and Crews in Western New York.** — MOWRY, H. H., in *United States Department of Agriculture, Bulletin No. 412* (Professional Paper of the Office of Farm Management). Washington, D. C., September 22, 1916.

The Office of Farm Management of the United States Department of Agriculture has published the results of information obtained from

farmers in Wayne, Ontario, Monroe, Tennessee, Livingston, Orleans and Niagara Counties. The summary of these data is given in Table I, which also gives the averages for the entire United States as determined by a survey made by the Department of Agriculture. This table gives the average daily work accomplished by the principal machines drawn by 2 or 3 horses and the work done by each man in the course of the different agricultural operations.

TABLE I. — *Summary and Comparisons.*

Operation	Average daily duty	
	Western New York	United States
	Acres	Acres
<i>Walking plough;</i>		
2 horses, 12-inch. . . . .	1.65	1.76
3 horses, 14-inch. . . . .	1.78	2.32
Sulky plough, 3 horses, 14-inch. . . . .	2.20	2.40
<i>Spike-tooth harrow:</i>		
2 horses, 8-foot . . . . .	13.0	10.8
3 horses, 10-foot. . . . .	17.3	15.3
<i>Spring-tooth harrow:</i>		
2 horses, 6-foot . . . . .	9.0	7.4
3 horses, 6-foot . . . . .	10.2	8.2
4 horses, 8-foot . . . . .	14.7	13.1
<i>Disk harrow, fresh ploughed land:</i>		
2 horses, 6-foot . . . . .	7.5	7.2
3 horses, 6-foot . . . . .	8.2	7.5
4 horses, 8-foot . . . . .	11.1	12.8
Land roller 2 horses, 8-foot. . . . .	13.8	13.2
Grain drill 2 horses, 6-foot . . . . .	10.0	8.8
Grain binder 3 horses, 6-foot . . . . .	10.4	11.1
Setting up bound grain, 1 man . . . . .	7.5	9.3
<i>Planting corn:</i>		
Hand planter, 1 man. . . . .	3.4	4.4
1 horse, 1 row . . . . .	5.2	6.9
2 horses, 2 row . . . . .	10.7	13.6
<i>Cultivating:</i>		
1 horse . . . . .	4.1	4.4
2 horse . . . . .	6.8	6.6
Cutting corn by hand, 1 man, yield 41-60 bushels . . . . .	1.1	1.5
Setting up corn after corn binder, 1 man . . . . .	3.4	4.0
<i>Corn binder:</i>		
2 horses . . . . .	5.3	6.6
3 horses . . . . .	5.7	7.3
Mowing hay (5-foot cut) . . . . .	9.0	8.9



	Average daily duty	
	Western New York	United States
	Acres	Acres
<i>Raking hay (10 feet wide):</i>		
1 horse . . . . .	15.0	16.3
2 horses . . . . .	17.6	17.9
Tedding hay, 2 horses . . . . .	14.3	14.5
Cocking hay, 1 man . . . . .	6.3	6.3
<i>Hauling hay from field to barn, 2 men and 2 horses:</i>		
Unloading by hand, . . . . .	4.9	4.4
Unloading with sling . . . . .	6.6	6.1
<i>Picking apples:</i>		
Yield 1-10 bushels. . . . .	52.3 bushels	34.0 bushels
Yield over 10 bushels . . . . .	70.0	44.80
Husking corn from shock, 1 man . . . . .	32.2	45.9
Threshing wheat from shock, 10 men and 6 horses	25.1	29.5
Hauling manure with spreader . . . . .	14.7 loads	13.1 loads

Farm land in the section where these data were obtained is somewhat rolling, but not to an extent to reduce appreciably the average amount of work that can be done daily. Some of the heavier soils reduced the amount of work that can be done daily with ploughs. The horses used in Western New York average 1211 pounds in weight. The average net day in the field in spring and summer work was found to be 9 hours and 38 minutes, and in haying and harvest it is 9 hours and 49 minutes.

The depth ploughed on stubble is on an average 66  $\frac{1}{2}$  in. and 2 horses are generally used; the ploughing on sod ranges from 6  $\frac{1}{2}$  to 7  $\frac{1}{4}$  inches and 3 horses are usually employed for this work. Owing to the heavy character of the local soils, the farmers in Western New York accomplish only about 80 to 85 per cent as much daily in their ploughing work as does the average farmer in the United States.

The average data for ploughing on sod and on stubble are given in Table II.

TABLE II. — *A fair day's work for walking ploughs and sulky ploughs in Western New York.*

	Horses	Width inches	On sod		On stubble	
			Acres	Number of farms averaged	Acres	Number of farms averaged
Work of walking ploughs	2	10	1.46	124	1.66	220
	2	12	1.47	217	1.65	315
	2	14	1.48	111	1.72	135
	3	10	1.70	86	1.82	52
	3	12	1.74	225	1.85	146
	3	14	1.78	198	1.93	140
Work of sulky ploughs	3	16	1.90	45	1.95	15
	3	12	1.95	86	2.11	86
	3	14	2.08	105	2.20	115
	3	16	2.26	51	2.37	42

The spike-tooth or smoothing harrow can be worked with 2-horse or 3-horse teams in a wide range of widths, as it is an implement of comparatively light draft. Three horses accomplish from 10 to 15 per cent more work on the same width of harrow than 2 horses.

Where 2 horses are required to draw widths greater than 10 ft., they appear to be overloaded, or that their daily efficiency is reduced. On hard soil, a 4-horse team finds an 8-foot or 9-foot spring-tooth harrow a heavy load. With 2 or 3 horses, any increase in width results in less speed and mileage per day. Tables III and IV give an average day's work for harrow.

TABLE III. — *A fair day's work for spike-tooth and spring-tooth harrows.*

	Width Feet	2-horse teams		3-horse teams		4-horse teams	
		Acres	Number averaged	Acres	Number averaged	Acres	Number averaged
		—	—	—	—	—	—
Work of spike-tooth harrow	5	11.2	15	11	2	—	—
	6	11.1	87	11.9	27	—	—
	7	12.0	102	13.2	33	—	—
	8	13.0	199	14.1	75	—	—
	9	13.8	43	16.4	48	—	—
	10	16.1	102	17.3	80	—	—
Work of spring-tooth harrow	12	14.8	20	19.1	38	—	—
	6	9	36	10.2	33	—	—
	7	9.3	6	10.9	21	—	—
	8	9.7	7	13.3	10	14.7	3
	9	—	—	—	—	18.0	8

TABLE IV. — *A fair day's work for disk harrows using teams of two, three and four horses respectively.*

Horses	Width Feet	On fresh-ploughed land		On well-packed land	
		Acres	Number averaged	Acres	Number averaged
		—	—	—	—
2	5	7.1	60	8.4	61
2	6	7.5	152	9.1	149
2	7	7.8	44	9.6	44
2	8	7.8	38	10.0	38
3	5	8.1	44	9.4	44
3	6	8.2	205	9.8	201
3	7	8.1	90	9.9	89
3	8	8.8	48	10.3	49
4	6	7.6	16	9.1	155
4	7	9.8	15	12.2	15
4	8	11.1	25	13.3	25

The data of land rolling are given in Table V.

TABLE V. — *A fair day's work for the land roller drawn by 2 horses.*

Width Feet	Acres	Number averaged
6	11.4	76
7	12.5	255
8	13.8	588
9	14.0	117
10	14.6	136
12	15.3	23

GRAIN DRILL. — Out of 1113 farmers, 951 use a 2-horsed grain drill sowing 11 rows; 67 use a 2-horsed grain drill sowing 10 rows and 95 a 2-horsed grain drill sowing 9 rows: these sow respectively 10.0; 9.6; and 9.2 acres daily.

GRAIN BINDERS. — Out of 1144 farmers, 901 use a 3-horsed 6-foot binder, reaping and binding on an average 10.4 acres daily; 83 have a 3-horsed, 7-foot binder reaping and binding on an average 11.3 acres daily; only 16 farmers use 2-horsed, 5 foot binders, reaping and binding 7-6 acres daily; 71 others reap and bind 9-3 acres a day with a 2-horse, 6-foot binder, while 73 reap and bind 9-6 acres a day with a 3-horsed, 5-foot binder.

SETTING UP SHOCKS AFTER A GRAIN BINDER. — Table VI shows the average acres of grain that a man can put up in shocks after a grain binder.

TABLE VI. — *A fair day's work for a man setting up grain in shocks after the grain binder.*

Straw Tons	Yield		Acres	Number averaged
	Grain Bushels			
1.3	20		7.7	278
1.4	25		7.6	380
1.6	30		7.4	313
1.7	35		7.3	25

The bulk of straw influences the daily acreage to some extent.

THRESHING WHEAT. — The amount of grain threshed daily is determined by the yield of the crop more than by any other condition.

TABLE VII. — *Threshing wheat from shock. — A fair day's work with average crews.*

Yield Bushels	Crew		Bushels daily	Acres daily	Number averaged
	Men	Horses			
0-20	8 or 9	4 or 6	561.7	24.3	124
21-30	9 or 10	6	715.3	25.1	244
31 and over	10 or 11	4 or 6	909.8	25.3	22

Table VIII gives the work of average crews in threshing from stack or barn, both for wheat and for oats.



TABLE VIII. — *Threshing wheat and oats from stack or barn. — Normal output of average crews.*

Crew		Wheat		Oats		Number averaged
Men	Horses	Yield	Bushels	Yield	Bushels	
8 or 9	2 or 4	20	733	35	1096	97
9 or 10	2 or 4	25	855	45	1296	107
9 or 10	2 or 4	30	914	55	1340	124

HANDLING MANURE. — Table IX shows the normal accomplishment to be expected from a manure-spreader operated by 1 man and using 2-horse and 3-horse teams respectively. The statistics obtained show that the great majority of farmers find 3 horses necessary for the operation of a spreader. The advantage of the spreader consists in the more even distribution of manure over the field, in the shorter time required to unload, and the greater ease of unloading by horse-power than by man-power. It takes about  $2\frac{1}{2}$  times as long to unload by hand as with the spreader.

On some farms the laborious work of handling manure from farm yards has been rendered unnecessary by the use of low-wheeled, low-priced waggons into which the manure can be emptied as it comes from the stable. The manure spreader can be set outside, so as to receive the contents of the carrier.

By hauling the spreader to the field as soon as filled, the laborious operation of loading from the ground by hand is eliminated and the manure goes directly to the field with a minimum of loss by leaching.

TABLE IX. — *A fair day's work in handling manure with a manure spreader.*

Horses	Rods hauled	Pounds in load	Loads hauled	Acres covered	Number averaged
2	61.2	2,317	14.5	1.7	123
3	70.4	2,689	14.7	1.8	355

OPERATIONS ON THE CORN (MAIZE) CROP. — Table X gives the normal efficiency of hand planters, 1-row and 2-row planters and the grain drill in planting corn.

TABLE X. — *A fair day's work with the implements used in planting corn.*

Implement	Width of rows Inches	Acres daily	Number averaged
Hand planter, . . . . .	36 42	2.9 3.4	74 113
One row, 1-horse planter, . . . . .	36 42	4.6 5.2	62 93
Two rows, 2-horse planter . . . . .	36 42	9.1 10.7	84 124
Grain drill, 2 horses . . . . .	36 42	11.3 11.6	192 533

The hand planter is about 60 per cent as efficient as the 1-horse planter,  $\frac{1}{3}$  as efficient as the 2-row planter and  $\frac{1}{4}$  as rapid as the grain drill.

As for cultivating, the 2-horse walking cultivator is about 50 per cent more efficient than the 1-horse cultivator, and the 2-horse riding cultivator is about 75 per cent more efficient than the 1-horse type and 13 per cent more efficient than the 2-horse cultivator. The statistical data on this subject are to be found in Table XI.

TABLE XI. — *A fair day's work in cultivating corn.*

Horses used	Type of cultivator	Acres cultivated daily	Number averaged
1	Walking	4. 1	1 077
2	do	6. 2	560
2	Riding	7. 1	1 133

Table XII gives the average acreage of corn cut by one man working with a corn knife, in one day in terms of ears per acre. The averages for New York for this operation are about 25 per cent less than the normal for the United States, the yield being the same. This may be accounted for in part by the fact that corn in New York is planted in drills instead of in hills, requiring more blows of the knife to cut a given number of stalks; also because a short-handled sickle is used in the East which requires much stooping, while a long straight-bladed knife is used in the West, which permits the work to be done while standing practically erect.

TABLE XII. — *A fair day's work for one man in cutting corn by hand.*

Range of yield (Bushels of ears) *	Acres cut daily	Number averaged
Under 40	1. 3	47
41-60	1. 2	187
61-80	1. 1	402
81 and over	1. 1	580

\* To convert to bushels of shelled corn divide by 2.

Where corn has been cut by a corn binder, a man's efficiency in setting it up in shocks is multiplied by 3 over what he can accomplish in cutting and setting up by hand. Table XIII gives the day's work for a man setting up corn after the corn binder.

TABLE XIII. — *A fair day's work for a man setting up corn after the corn binder.*

Yield per acre (bushels of ears)	Acres per day	Number averaged
50	3. 5	102
75	3. 4	165
100	3. 3	474

Table XIV shows the day's work of a corn binder. It is about 20 per cent less than the average for the United States. This is in part accounted for by the fact that corn is not extensively grown in New York but more intensively. The methods of sowing already mentioned have also something to do with the matter.

TABLE XIV. — *A fair day's work with the corn binder drawn by 2 and 3 horses respectively.*

Horses	Acres cut daily	Number averaged
2	5.3	190
3	5.7	1001

In husking corn from the shock in West New York, one man averages only from 65 to 75 per cent of the average for the United States (owing to reasons already stated), about 35 bushels per day being the normal amount husked per day in this section. This is shown by Table XV.

TABLE XV. — *A fair day's work for a man husking corn from shock.*

Range of yield (bushels of ears)	Acres per day	Bushels per day	Number averaged
Under 41	0.66	36.3	26
41-60	0.62	32.2	122
61-80	0.47	32.6	293
81 and over	0.40	36.0	431

OPERATIONS ON THE BEAN CROP. — Beans are planted with a grain drill, cultivated with an ordinary cultivator, and harvested with a bean harvester, an implement drawn by 2 horses and having 2 long knives, each of which cuts a row, the 2 rows being thrown in the centre between the rows. The beans are then thrown into small piles with a pitchfork, and from time to time the piles are forked and turned over, so that the pods will dry out and cure suitably for threshing. The data of these operations are found in Table XVI.

TABLE XVI. — *A fair day's work for the operations in bean-growing.*

Operation	Horses	Men	Acres daily	Number averaged
Planting with grain drill . . . . .	2	1	10.9	1040
Harvesting with bean harvester . . . . .	2	1	7.6	982
Bunching with fork . . . . .	—	1	2.8	793
Forking with fork . . . . .	—	1	2.7	819

HAYING OPERATIONS. — The data relating to these are set forth in Table XVIII.

TABLE XVII. — *Carting the bean-crop.*

Men	Crews		Area carted per day	Number averaged
	Horses	Wagons		
2	2	1	5.51	459
3	2	1	6.5	355
4	4	2	10.28	64
5	4	2	10.89	35
6	4	2	12.18	17



TABLE XVIII. — *A fair day's work for implements, men and teams used in making hay.*

Operation	Men	Horses	Width Feet	Acres daily	Number averaged
Mowing . . . . .	I	2	4 1/2 5 6	8.3 9.0 10.2	32 974 195
Raking . . . . .	I	1 2	10 10	15.0 17.6	175 424
Bunching . . . . .	I	1 2	10 10	13.1 16.3	89 164
Tedding . . . . .	I	2	—	14.3	658
Cocking . . . . .	I	—	—	6.3	1 044

Table XIX shows the day's work of the crews ordinarily used in New York in hauling and unloading hay.

TABLE XIX. — *A fair day's work with crews used in hauling hay from field to barn and unloading by hand.*

Men	Crews		Tons daily	Acres daily	Number averaged
	Horses	Waggon			
2	2	1	7.7	4.9	342
3	2	1	8.8	5.3	509
3	4	2	10.0	5.6	11
4	4	2	13.3	7.7	50
5	4	2	14.8	8.7	65

Unloading with hay sling, or hay fork, increases the efficiency per day about 45 per cent, as is shown by Table XX.

TABLE XX. — *A fair day's work for crews hauling hay from field to barn and unloading with hay sling, or fork.*

Men	Crews		Tons daily	Acres daily	Number averaged
	Horses	Waggon			
2	2	1	10.7	6.6	290
3	2	1	11.6	7.5	496
3	4	2	14.9	9.3	9
4	4	2	17.5	9.8	58
5	4	2	20.1	11.7	82

The efficiency of the crews can be increased about 10 per cent by the use of the hay loader in the field. Where stacking is done in the field, or where the hay field is

within 60 rods of the barn, hay can be put away about 75 per cent more rapidly with the over-shot stacker (used for stacking) and the sweep rake (for collecting) than with waggons and racks. The stacker and sweep rack are usually employed in the Western States.

OPERATIONS ON THE CABBAGE CROP. — Table XXI gives the data respecting planting cabbages with a transplanter; there must be always 3 men on this machine. The additional men (who are alone entered in Table XXI) are used to bring plants and water to convenient points for the transplanter. The efficiency per day is not greatly increased by additional men, 2 men and 2 horses adding only about 15 per cent to the amount done daily by 1 man and 1 horse. Two extra men and an extra team are, however, used more frequently than smaller numbers.

TABLE XXI. — *A fair day's work in setting cabbage, using 3 men on the transplanter and additional men and horses as indicated.*

Extra men —	Extra horses —	Acres planted daily —	Number averaged —
—	—	3.4	53
1	—	3.4	42
2	—	3.5	65
1	1	3.5	47
2	1	3.7	83
1	2	3.8	30
2	2	4.0	155

Table XXII gives the average number of loads and tons of cabbages that can be harvested daily and unloaded on the farm. The smaller crews are most frequently used as the larger ones do not give results corresponding.

TABLE XXII. — *A fair day's work for crews harvesting cabbage and sorting in the barn.*

Men —	Crews —		Loads daily —	Tons daily —	Number averaged —
	Horses —	Waggons —			
2	2	1	7.4	9.8	142
3	2	1	8.0	11.4	107
4	2	1	9.4	13.5	50
4	4	2	12.3	16.4	48
6	4	2	14.9	20.7	16

Table XXIII shows the number of loads that can be handled daily with the respective crews where the cabbage is hauled directly from field to market. On account of its great weight and bulk, cabbage is not grown to any considerable extent except on farms 2 or 4 miles from shipping point.

TABLE XXIII. — *A fair day's work for crews harvesting cabbage and hauling directly to market—loads per day.*

Crews			Miles to Market									
			1		2		3		4		5	
			Loads	Number averaged	Loads	Number averaged	Loads	Number averaged	Loads	Number averaged	Loads	Number averaged
2	2	1	5.1	13	3.9	51	3.1	29	2.5	23	2.5	13
3	2	1	5.8	17	4.6	30	3.5	16	3.5	12	2.4	5
4	2	1	4.7	3	4.7	16	3.6	18	3.5	3	3.6	5
4	4	2	10.4	5	6.9	15	6.0	10	4.7	5	4.0	1
6	4	2	11.3	5	7.0	2	6.5	4	7.0	2	4.1	1

OPERATIONS ON FRUIT CROPS. — The data given in Tables XXIV and XXIX were obtained in Western New York under conditions where orcharding is on a commercial basis and the work is well standardised.

They refer to well-established orchards and the customary methods and practice which obtain among the vast majority of growers. Baldwins and Greenings predominate among the orchards. Trees are pruned quite regularly, few, if any, neglected orchard conditions and abnormal factors being incorporated in the averages.

TABLE XXIV. — *A fair day's work in pruning fruit trees and in thinning fruit from apple trees.*

Operation	Trees daily	Number average
Pruning apple trees (16 years old) . . . .	28.6	803
Pruning apple trees (30 years old) . . . .	12.6	769
Thinning out surplus apples (30 years trees). . . .	12.4	528
Pruning peach trees (8 years hold) . . . .	37.7	449

Table XXV shows the number of bushels that one man can pick daily, where the yield of the tree varies:

TABLE XXV. — *A fair day's work for one man in picking peaches from trees of average size, according to yield per tree.*

Yield per tree (bushels)	Bushels picked per day	Number averaged
1	22.2	17
2	33.6	101
3	34.7	99
4	38.3	50
5	39.8	50
8	45.9	13
10	54.3	7



From Table XXVI it appears that about the same number of peaches can be handled daily by one man packing into baskets as can be picked from the tree. In general the smaller the basket, the less the quantity that can be packed in a day. The  $\frac{1}{3}$ -bushel basket is most commonly used.

Mechanical graders for sorting peaches were almost unknown in this area at the time these data were collected.

TABLE XXVI. — *A fair day's work for 1 man in packing peaches in baskets.*

Size of basket (bushels)	Number of bushels daily	Average bushels daily	Number averaged
$\frac{1}{4}$	88.2	22.1	17
$\frac{1}{3}$	97.7	32.6	266
$\frac{1}{2}$	79.5	39.7	44
1	57.6	57.6	15

Table XXVII gives the daily duty of one man in picking apples. In good years pickers prefer to be paid by the bushel or barrel, and work more rapidly than when paid by the day. Under average conditions in the Western New York territory, the yield of apples is from 4 to 6 bushels per tree, and the average picker gathers from 20 to 25 barrels daily.

TABLE XXVII. — *A fair day's work for a man in picking apples.*

Yield per tree (bushels)	Bushels per day	Number averaged	Yield per tree (bushels)	Bushels per day	Number averaged
6	53.2	11	20	66.9	207
10	54.5	88	25	75.8	81
15	63.5	199	30	78.6	150

Mechanical devices for sorting and packing apples are seldom used in Western New York. A simple barrel header worked by 1 man only is used.

When apples are sorted by hand and packed in barrels, the daily amounts set out in Table XXVIII should normally be accomplished.

TABLE XXVIII. — *A fair day's work in sorting and packing apples with the number of hands indicated.*

Crews		Barrels daily	Number averaged
Sorters	Packers		
1	1	56.7	209
1	2	65.4	11
2	1	77.4	228
2	2	88.7	118
3	1	98.4	27
3	2	115.0	37
4	2	124.9	9

Not many of the commercial orchards in New York are over 6 miles from market. The number of trips that can be made daily with loads of fruit for distances from 1 to 8 miles is shown in Table XXIX. The usual load is 20 to 22 barrels of apples and 55 to 60 bushels of peaches.

TABLE XXIX. — *A fair day's work for man and team in hauling fruit to market.*

Miles to market	Loads per day	Number averaged	Miles to market	Loads per day	Number averaged
1	6.3	58	4	3.0	150
1 1/2	5.6	53	5	2.3	128
2	4.8	173	6	2.1	77
2 1/2	4.1	79	7	1.9	29
3	3.7	210	8	1.9	17
3 1/2	3.4	38	—	—	—

277 - **The Valuation of Feeding Stuffs.** — See No. 257 of this *Bulletin*.

278 - **Method for the Investigation of the Aniline Derivatives and Other Foreign Colours in Wine.** — MASONI, GIULIO, in *Le Stazioni sperimentali agrarie italiane*, Vol. XLIX, Part. 7-8, pp. 336-376. Modena, 1916.

INDUSTRIES  
DEPENDENT ON  
PLANT  
PRODUCTS.

In a preceding note (*Le Stazioni sperimentali agrarie italiane*, Vol. XLVIII, 1915), the author has described his method for investigation of aniline derivatives used for colouring red wines. The method is as follows:

In a measuring glass, pour 2 cc. of wine, add 2 cc. of 5% potassium ferro-cyanide and 5 cc. of 15% neutral lead acetate, heat to boiling for a few seconds, leave to stand.

A precipitate quickly settles, leaving a limpid liquid, colourless if the wine is pure, pink if the wine contains aniline colours. The test is very sensitive and shows the presence of these colours in amounts less than the minima necessary to produce a perceptible colour in the wine.

In previous experiments the writer only used wines at least 3 months old. In this second communication he indicates the results obtained with: white wines, very new wines; colouring matters of vegetable origin (elder, phytolacca, logwood, bilberry, sunflower, caramel) and of animal origin (cochineal extract); other aniline colours besides those already tried, such as: *reds*, fuchsine — safranine — malveine — Bordeaux B — Bordeaux B. S. — poppy 3 R. — erythrosine — azorubine — eosin red — xyloidine scarlet — croceine scarlet 3B — Magdala red — true red — *yellows*, chrysaniline, vesuvine — tropeoline 1000 — tropeoline 00 — Martius yellow — Victoria yellow — naphthol yellow — solid yellow — aurantia.

New pure wines with this method give: a violet red liquid for red wines; a yellowish liquid with white wines; the reaction is only applicable to them if the ferrocyanide solution is rendered alkaline by adding 2% of soda, so that pure wines give a colourless liquid and that the method can be used. The alkalinity does not interfere with the reaction. The article contains a table showing the colours of the lacs and of the liquids obtained from wines containing one of the various colouring matters under discussion.

279 -- **The Sugar Industry in Russia.** — KRIOUKOV, N. A. in *The Agricultural Gazette*, Nos. 35 to 41, pp. 945-948; 976-978; 998-1000; 1018-1020; 1041-1043; 1065-1066; 1085-1086. Petrograd, 1916.

AREA UNDER SUGAR BEET AND THE SUGAR PRODUCTION. — In Russia there are 13 regions where sugar beets are grown:

1) *The South-western*, including the Governments of Kiev, Volhynia, Podolia, Cherson and Bessarabia;

2) *The Central*, including the Governments of Kursk, Poltava and Tchernigov;

3) *The Eastern*, including the Governments of Voronej, Tambov, Orel and Toula;

4) *The Polish*, including the Governments of Warsaw, Kalich, Lublin, Cholm, Lomja, Petrokov, Plozk and Radom.

During the 25 years period between 1887-1888 and 1911-1912, the following changes have taken place in the *area under sugar beet* and in the *general production* of this plant.

Regions	Area Under Sugar beets (1)			Total production in quintals (2)		
	in 1887-1888	in 1911-1912	% of increase	in 1887-1888	in 1911-1912	% of increase
South-Western. . .	137 387 ha	441 865 ha	222	152 180	516 503	239
Central. . . . .	62 247 "	234 207 "	276	82 148	260 728	217
Eastern. . . . .	14 153 "	34 254 "	142	14 480	26 375	82
Polish . . . . .	34 771 "	77 382 "	123	37 259	98 293	164
Totals. . . . .	248 558 ha	787 708 ha	217	286 067	901 900	214

(1) 1 hectare = 2.471 acres.

(2) 1 quintal = 220 lbs.

The figures given in this Table show the importance of each region and the amount of progress made.

The South-Western region has the largest area under sugar beet, which amounted to 56 per cent of the total area in 1911-1912; next comes the Central region with 30 per cent, the Polish with 9.8 per cent, and lastly the Eastern with 4.2 per cent.



The *total area* under sugar beet has increased 217 per cent in 25 years, that is to say, it has been more than trebled; the *total production* has increased to almost the same extent.

The greatest extension of the area of sugar beet-growing has been in the Central Region (276 %), while the production has augmented most in the South Western. In the Polish Region, the area has increased 123 per cent, and the production 164 per cent.

The variations in the *unit production* of sugar beet during these 25 years (from 1887 to 1912) have been as follows:

In the South-Western Region from 117 to 188 quintals per ha

» Central	» »	131 to 199	»
» Eastern	» »	78 to 168	»
» Polish	» »	143 to 245	»

(1 quintal per hectare = 0.79 cwt per acre).

*Average in all Russia* from 124 to 202 quintals per ha.

The sugar beet is cultivated in Russia in 3 categories of *agricultural undertakings*, viz.: 1) sugar beet fields belonging to sugar factories; 2) large farms growing beets for the nearest sugar factory under fixed conditions; 3) small farms that happen to be situated near a sugar factory.

In 1912, the *total area under sugar beets* was divided amongst these 3 categories in the following manner:

Regions	Fields belonging to sugar factories	Large farms	Small farms
South Western . . . . .	24.6 %	51 %	24.4 %
Central . . . . .	46.7	36.3	17
Eastern . . . . .	54	31	15
Polish . . . . .	3.4	59.6	37
In all Russia. . .	30.4 %	46.6 %	23 %

From Table II, it is seen that sugar beet-growing in fields belonging to the sugar factories is more developed in the Eastern region, where 54 per cent of the total area devoted to this crop is the property of the sugar factories. In the central region it decreases, and in the South Western, the sugar factory beet fields only occupy  $\frac{1}{4}$  (24.6 %) of the whole area, while  $\frac{1}{2}$  (51 %) belongs to the large farms.

Finally, in the Polish region, the sugar factories only cultivated 3.4 % of the total area under sugar beets, while 59.6 % of the area belong to large farms.

As for the *unit production* of the sugar beet, it is considerably lower on the small farms, as is shown by the data of 1912.

Regions	Large beet-growing farms and beet fields belonging to sugar factories	Small beet-growing farms
South Western . . . . .	186 quintals per ha	141 quintals per ha
Central . . . . .	176 » »	125 » »
Eastern . . . . .	118 » »	104 » »
Polish . . . . .	203 » »	167 » »

COST OF SUGAR BEET PRODUCTION. — In the South-Western region, the cost of growing 1 ha of sugar beet was apportioned as follows, on an average, in 1910-1912.

Land improvement and rent . . . . .	41 — 49 fr.
Manures . . . . .	17 — 19
Working the land . . . . .	27 — 32
Sowing . . . . .	6.1 — 7
Seeds . . . . .	24 — 27
Hoeing . . . . .	8.5 — 10
1st Singling . . . . .	22 — 24
2nd Singling . . . . .	12 — 15
Hilling up . . . . .	3.7 — 5
Defence against agricultural pests . . . . .	7 — 10
Harvesting . . . . .	34 — 44
Transport to sugar factory . . . . .	37 — 44
Sundry expenses . . . . .	1.2 — 5
Total . . . . .	240.5 — 291 fr.

With an average production of from 180 to 195 quintals per ha, the cost of producing 1 quintal of sugar beets amounts to 1.48 — 1.57 fr.

SUGAR FACTORIES AND REFINERIES. — The number of sugar factories in Russia, during the last 27 years, was as follows:

In 1887 sugar factories doing business . . . . .	218
» 1912 . . . . .	281
» 1913 . . . . .	288
» 1914 . . . . .	292

The following data show how the sugar factories were divided amongst the different regions, and also their output:

Region	Nº of factories	Total sugar output, thousands of quintals
South Western . . . . .	145	1 096
Central . . . . .	71	5 792
Eastern . . . . .	15	537
Polish . . . . .	50	1 988
Totals . . . . .	281	18 413

It is interesting to compare the data respecting the number and output of the sugar factories with the following figures giving the *sugar yield* of the beetroots used during the different years:

Periods	Average yield of beets per ha.	Average yield of sugar per ha.	Sugar percentage
1887-1892. . . . .	168 quintals	16 quintals	9.6 %
1892-1897. . . . .	159 »	17 »	10.7 %
1897-1902. . . . .	142 »	16 »	11.4 %
1902-1907. . . . .	152 »	19 »	12.3 %
1907-1912. . . . .	161 »	23 »	14.0 %

These data show that during the last 25 years, the sugar content of the beet has considerably increased; the average percentage having risen from 9.6 to 14 %, which means that the sugar yield per unit of area has increased about  $1\frac{1}{2}$  times.

As for the differences in *sugar yield in the different zones*, they were as follows for the season 1911-1912:

Regions	Sugar yield per ha.	Sugar percentage
South Western . . . . .	23 quintals	13.1 %
Central . . . . .	25 »	14.9 %
Eastern . . . . .	16 »	13.7 %
Polish . . . . .	26 »	14.0 %
Average for whole of Russia . . . . .	24 »	13.6 %

*The cost of producing 1 quintal of sugar during different periods was as follows*

In 1893-1894. . . . .	35.98 fr.
» 1899-1900. . . . .	34.12
» 1905-1906. . . . .	40.37
» 1909-1910. . . . .	36.15
» 1911-1912. . . . .	32.56

In Russia, a sugar factory which produces 50,000 quintals per year is considered one of average size.

It is necessary, in order to obtain this output, to have about 1 630 000 fr. of working capital, 32.50 fr. per quintal of sugar. The value of this sugar factory is estimated at 2 666 000 fr.

With regard to the *sugar consumption* per head in Russia, it was: 2.8 kg in 1887-1888 — 6.8 kg in 1911-1912 — 7.2 kg in 1913-1914.

In normal times, Russia exported as *excess sugar production*; 544 000 quintals in 1887; 5 185 000 quintals in 1911-1912.

There are many refineries in the chief centres of sugar consumption, as for example Petrograd, Kiev, Odessa, etc. Many of the factories, however, have built refineries which form part of the main building.

According to the data of 1911-1912. the *output of refined sugar* was as follows:

	No.	Amount of refined sugar. Thousands of quintals
Refineries . . . . .	19	5 081
Refineries attached to sugar factories.	47	2 862
Totals. . . . .	66	7 943

During the five-years period 1887-1892, the output of refined sugar amounted to 67 per cent of the whole quantity produced: in 1911-12 the percentage was only 44.

**BYE-PRODUCTS OF THE SUGAR INDUSTRY.** — In Russia, these are not yet used in a complete and systematic manner. At the present time, the value of these substances obtained per quintal of sugar is only 2.40-4.80 fr., while it could be raised to about 9 francs, as is shown by the example of other countries. The first steps in this direction



have been taken and further progress will certainly exert some influence on the cost of unit sugar production.

SUGAR BEET SEEDS. — For information on this subject, see article No. 234 of the *Bulletin*.

In conclusion, the writer also gives some account of the effect of the war upon the sugar industry in Russia.

280. — **The Utilisation of Milling Residues in Hungary** — I. ZEGEN, A., Vetch and Corn-Cockle Seeds from Siftings, in *Kísérletügyi Közlemények* (Bulletin of the Hungarian Agricultural Stations), Vol. XIX, Part 2, pp. 323-350. Budapest, July-September 1916. — II. GYÁRFÁS J., Cultural Experiments with Vetch seeds from siftings in Hungary. *Ibidem*, pp. 353-377.

I. — This article sets forth the data obtained in the course of many years' experiments on milling residues; it is chiefly concerned with the answers to the following questions:

1) Are the products put on the market under the name of, "Vetch seed from siftings", by the large steam mills of Hungary, and which are used as cattle food, or more recently for sowing, suitable for the latter purpose?

2) Upon what factors does their value depend?

The Budapest mills annually produce from 9 000 to 15 000 quintals of these residual vetch seeds, which represent from 0.5 to 0.6 per cent of the wheat ground.

The mills belonging to the "National Association of the commercial millers of the provincial towns" annually grind about 10 million quintals of wheat of which the vetch seed residue may be estimated at 20 000-30 000 quintals. In these mills, the wheat is freed from 0.2 to 0.4 % of vetch seeds on an average.

The writer had 10 samples of milling residues from 8 large mills at Budapest tested botanically. The results obtained are set forth in several tables, and show that under the name of "vetch seed from siftings", are sold products consisting for the greater part (88.82 to 99.08 %) of the seed of wild plants of *Vicia sativa* and *V. segetalis*, as well as some of *V. striata* (= *V. pannonica*), all vetches which are very suitable for forage crops.

Vetch seeds from siftings contain, as a rule, but few foreign seeds, exceptionally these amount to 9 %. The analyses show that the cultural value of these siftings depends upon the number of valuable seeds they contain, and upon their degree of purity.

These vetch seeds are obtained fairly pure in the mills themselves by means of special cylindrical sorters. Since, however, vetch seeds are also sold coming from mills with less perfect apparatus, and which therefore have not undergone the same treatment, the Hungarian seed merchants have, for some time, cleaned the above mentioned products by passing them through spiral sorters.

Given the great difference in the market price of cultivated vetch seeds and that of the seed obtained from siftings, it is necessary to insist upon the latter being sold under their proper name, all the more so, since if they are to be used for sowing, these seeds have to undergo a special treatment before sowing, on account of the high percentage of hard seeds present.

As for some time past the vetch seed residues from the mills have been offered for

sale for sowing purposes, not only unadulterated but also mixed with the seed of cultivated vetches, and as it is very difficult to distinguish between these two kind of seeds, it is necessary before purchase to consult a Seed Experiment Station.

The writer has also examined samples of corn-cockle (*Agrostemma Githago*) seed, (1) from 8 mills in Budapest. These were chiefly composed of fragments of grains of cereals, seeds of various species of wild vetch, corn-cockle seeds and, to a less extent, of foreign seeds. Since this milling residue contains many varieties of seed which diminish its nutritive value, it is necessary to analyse it botanically before feeding it to cattle. Further, on account of the very variable number of corncockle seeds present in the siftings, only a certain quantity proportional to the live weights of the cattle should be daily given to them, in order to avoid all risk of poisoning the animals.

In Hungary, the milling residues contain seeds of *Adonis aestivalis*; in a sample analysed by the writer there were as many as 3.8%.

As this seed is generally considered poisonous, the Biological and Stock-Feeding Station carried out feeding experiments on a pig and a goose, using a ration of barley mixed with 4% of *Adonis* seed. These animals ate the mixture very unwillingly and only when driven to do so by hunger; they lost much live weight. However, after being fed this ration for 16 days, they showed no symptoms, of poisoning. The great repugnance which they manifested to the food, appears to have been due to the very large amount (20.53%) of fatty oil present in the seeds of *Adonis*.

The latter seeds can easily be eliminated by employing spiral sorters, therefore the writer advocates their being removed from all corn-cockle seed used as a cattle feed.

The corn-cockle seed from the Hungarian siftings also nearly always contains seeds of *Lathyrus aphaca*, but their presence in very small quantities does not detract from the value. In the samples examined by the writer, however, the seeds of *Lathyrus apaca* amounted to 8.8 and 21.76%; such corn-cockle seed should not be used as a feed.

II. — With a view to estimating the cultural value of the vetch seed from milling residues, the Royal Hungarian Agricultural Station of Magyaróvár carried out in the course of 1912 and 1913-14, comparative cultural experiment on large scale, both in its own experiment fields, and with the assistance of various estates in the country.

90% of these seeds belonged to large-seeded varieties of vetch, namely *Vicia sativa* L. — *V. segetalis* — *V. striata* M. B. — *V. pannonica* A. — *Vicia villosa* Roth — and were therefore considered as being a good mixture from the cultural point of view. The comparative experiments made in the spring of 1912 were carried out on vetch seed from siftings and on the common spring vetch, both of which were mixed with an equal quantity of oats or barley. These experiments showed that, generally speaking, vetch seeds from the milling residues are slower in germinating than the seed of cultivated vetch, and that on account of their less vigorous growth, they flower some days later, or under unfavourable circumstances, even from 1 to 3 weeks later. Further, they usually give a late cutting. Therefore in districts with a hot climate, vetch seed from siftings should be grown with oats, rather than with early barley; also, the sowing should be done as early as possible.

(1) See B, 1916, No. 1191.

(Ed.)

The yield of green forage was estimated in 9 estates, in 2, they were nearly equal, while in the other 7, the common spring vetch produced a heavier crop than the vetch seed from the residues.

The hay yield was also determined in 11 estates; in 3 the crops were equal, but in 8, the superiority of the common vetch was clearly shown.

From the data set forth in several tables, it is seen that vetches from siftings, when sown in the spring, sometimes produce as good a crop as the common vetch; but in the majority of cases, they are less productive. This difference is probably due to the fact that the residual vetches, on account of their weak growth at first, are more susceptible to unfavourable cultural conditions, and especially to bad weather, than the spring vetch, which has a shorter growth period. It is only in regions where the conditions are favourable, that the residual vetches can rival the common vetch from the point of view of their yield. On light soils in somewhat dry districts therefore, they are less suited to replace the common spring vetch.

In the course of the experiments of 1913-14, the residual vetches were sown in autumn together with rye and wheat respectively, and at the same time as the common winter vetch (*V. sativa*), and *V. villosa*. Here again, though in less marked degree, the residual vetches proved inferior as regards germination and development, being somewhat weak at first. This renders it necessary to sow them early in the autumn, so that they may have developed sufficiently before the winter. When this was done, the residual vetches proved almost as cold resistant as *V. villosa*. In the spring, the residual vetches gradually overtook the other vetches grown, and even outstripped the common spring variety which had been sown in the spring and had been the subject of the same series of experiments. The residual vetch and the common winter variety flowered at the same time; but the former flowered from 1 to 4 weeks sooner than the common spring vetch. This proves that the residual vetches rank amongst the early forage plants. As regards yield, the former cannot compete with *V. villosa*, but come near the common spring and winter varieties.

The comparative experiments of the 2 years of cultivation also showed that the stems of the residual vetch dry more easily than that of the cultivated vetches, that its leaves do not break so readily when the hay is turned, and that it makes an excellent forage (both when green and when dried), which is readily eaten by animals.

It may be seen from all that has been said, that vetch grown from siftings consisting of the seeds of wild large-seed varieties can, under favourable circumstances, form a good and cheap substitute for cultivated vetch, and that it may constitute an excellent fodder whether fresh, or dried.

## 281 - The Drying for Milling Purposes of Damp and Garlicky Wheat. —

Cox, J. H., in *United States Department of Agriculture, Bulletin No. 455* (Professional Paper), pp. 1-12, Washington, December 2, 1916.

The artificial drying of wheat facilitates the removal of the garlic bulblets by subsequent cleaning; it may also be advantageously adopted by mills, in order to obtain flour free from the smell of garlic.

The experiments described in the bulletin analysed were undertaken for the purpose of determining the best method of artificially drying, cleaning, and handling garlicky wheat. Wild garlic (*Allium vineale*) is



found in the Atlantic coast region from Massachusetts to Georgia, and as far inland as Missouri. The results obtained show that practically no bad effects are produced by drying wheat at 140° F. (60° C.), and that this temperature is probably the most satisfactory for the drying of wheat, either with, or without garlic, for milling purposes. More extensive experiments may show that wheat can be dried at a higher temperature than 140° F. (60° C.) without having a bad effect on the flour as regards its bread-making properties. Every test, except one, where the wheat was dried at 180° F. (82° C.) and above, gave poorer results in the baking test from the standpoint of loaf volume and texture, than when dried at 140° F. (60° C.).

If wheat is dried down to 9 per cent of moisture, or below, for the removal of garlic, great care must be taken in tempering it back to the normal amount of moisture. In order to do this, the wheat should be tempered at least twice, and more if necessary. After the wheat is tempered, it should be stored several hours before mixing, or before another tempering is made, in order to allow the moisture to penetrate into the kernel. Several hours after the last tempering, the wheat should be run from the bin and a thorough mixture made, in order that the grain which passes through the rolls may be mixed as evenly as possible.

282 — **The Retractive Index of Olive Oil and Its Relation to Acidity and Rancidness.** — CUTOLO A., in *Le Stazioni Sperimentali agrarie italiane*, Vol. XLIX; Parts 7-8, pp. 377-387. Modena, 1916.

In previous papers, the writer has stated that the refractive index of oils decreases as their acidity increases. This statement has been confirmed by several other writers. The limits assigned to the refractive index of olive oil are a minimum of 62 and a maximum of 63 estimated at 25° C. by the Zeiss refractometer.

The writer has, in fact, during over 10 years always obtained results within these limits. In a series of estimations made in view of the work in question, the writer ascertained the following facts: 1) in new well-prepared oils with an acidity of about 1 per cent, the refractive index is 63; 2) the refractive index decreases with the increase of the free, fatty acids, that is to say with the acidity. 3) The refractive index rises with the increase in the oxidation and polymerisation products, viz., as the oil becomes more rancid. The writer has further determined that the best means of preparing the sample for estimating the refractive index, is to wash it in boiling alcohol and water.

- 283 — **Cooling Hot-Bottled Pasteurised Milk by Forced Air.** — AYERS, S. H., BOWEN, J. T., JOHNSON, W. T., in *United States Department of Agriculture Bulletin*, No. 420, (Professional Paper) pp. 1-38, Washington. October 27, 1916.

Since 1912, the process of cooling hot-bottled pasteurised milk by means of forced-air draught has been studied in the Dairy Division of the Bureau of Animal Industry in the United States. The first experiments were conducted on a laboratory scale, but the results led to their being extended to a small commercial scale in 1913. This work is the subject of the present paper by the writers.

The results obtained indicate that it is commercially practicable to cool hot pasteurised milk in containers not larger than quart bottles by forcing cold air downward over them when the air is at a temperature of  $4.4^{\circ}\text{C}$ ., or lower.

From a hygienic point of view, the important advantage of the process of bottling hot pasteurised milk in hot bottles lies in the fact that bottle infection is eliminated, and if the bottles can be cooled by forced air circulation, the process of pasteurisation would be raised to its highest state of efficiency by a relatively simple process.

The method adopted is as follows. The milk after being pasteurised in ordinary holders for 30 minutes at a temperature of  $60\text{--}61^{\circ}\text{C}$ ., is bottled hot in special over sized milk bottles which have been sterilised by steam. The bottles are then closed by ordinary sterile caps, and the crates of hot-bottled sterilised milk are cooled by stacking in a refrigerator room and blowing cold air through the crates. In the cold season, outside air could be used, and in the warm season, refrigerated air could be circulated through the crates.

This process was modified, but without obtaining satisfactory results, by substituting for the separate pasteurisation of milk in large vessels and steamed bottles, the pasteurisation of milk, after it had been put in bottles, by means of a current of steam. It had been found impossible to heat the bottles uniformly to  $62.8^{\circ}\text{C}$ . by means of forced air circulation.

The duration of the pasteurising process and the method of cooling the bottles by a cold air current have not been modified.

The writers have collected in this bulletin some experimental data respecting the cooling of hot pasteurised milk in bottles, first by means of the ordinary air, and then by a current of cold air produced by a refrigerator. The following are the points of chief practical importance.

Cooling by means of natural circulation is too slow for satisfactory application on a commercial scale. A bottle of hot milk will cool about  $\frac{1}{3}$  faster in circulated air than in still air at the same temperature.

When the cold air was forced up through the crates, there was a wide variation in the temperature of the same-sized bottles. This variation was reduced by reversing the current every 15 minutes, first up and then

down through the crates. The best results were obtained when the air was forced down, for by this means, the maximum difference in temperature was reduced to 2.5° C. and the average to 1.4° C.

With air at 4.4° C. forced down through the crates at the rate of approximately 2,500 ft. a minute, the milk was cooled from about 60° C. to 10° C. in about 2 hours. With air at 1.1° C., and at the rate of about 1,700 ft. a minute, the bottles were cooled through the same range of temperature in approximately 1 hr. and 30 min., and when it was at 6.6° C. and forced down through the crates at the last-mentioned rate, the bottles were cooled from about 60° C. to about 10° C. in about 1 hr. and 20 min.

Bacterial researches indicate that if milk is cooled from 62.8° C. to 10° C. within 5 hours after pasteurisation, no more bacterial increase will take place than if the milk were cooled immediately to the same temperature.

In order to have a wide margin for safety, it is well that the cooling process be started immediately after the hot pasteurised milk is bottled and that it be completed within 3 hours. This can easily be done, even where the work is carried out on a commercial scale.

The cooling of milk is absolutely essential in order to restrain bacterial growth and slow natural cooling cannot replace artificial cooling. So far as the laboratory experiments of the writers indicate, the artificial cooling of hot-bottled pasteurised milk has no appreciably detrimental effect on the cream and the flavour of the milk.

284 - **The Increasing Use of Forage Silos on Farms in the United States.** — *Hoard's Dairyman*, Vol. LII, No. 20, pp. 695 and 717. Fort Atkinson, Wis., December, 8, 1916.

The rapid increase in the number of silos used for preserving forage on farms in the United States has induced the Editor of "Hoard's Dairyman" to have the following table compiled. The work has been done at the expense of considerable patience, and the data have been checked and verified as far as possible. The Table not only gives the number of silos existing in the different States of the North American Confederation on July 1, 1916, but also the number erected in the various States during the last financial year. This enables the reader to realise better the rapidity with which the silo is becoming a characteristic rural object and an indispensable adjunct to American farming, whether the farm is stocked with milch cows, or with cattle of all kinds.

The cylindrical, external silo has replaced all other forms of silos and all the other systems of ensilage which were tried when this method of preserving forage first came into vogue.

For these cylindrical, external silos, which are constructed near the cow-houses, different materials are employed. Wood is most commonly

AGRICULTURAL  
PRODUCTS:  
PRESERVING,  
PACKING,  
TRANSPORT,  
TRADE.



*Number of silos in the United States.*

States —	No. of silos, July 1, 1916 —	No. of silos erected from July 1, 1915 to July 1, 1916 —	Aver. capacity tons, —	Principal Crops used for silage —
Alabama . . . . .	290	—	—	—
Arizona . . . . .	86	44	128	Kafir, corn (maize).
Arkansas . . . . .	1 500	950	75	Corn, sorghum.
California . . . . .	700	200	100	Corn, sorghum, alfalfa.
Colorado . . . . .	1 600	265	150	Corn, barley, peas.
Connecticut . . . . .	1 350	—	100	Corn.
Delaware . . . . .	700	—	—	—
Florida . . . . .	100	25	100	Corn, sorghum, Japanese cane.
Georgia . . . . .	100	25	60	Corn, sorghum.
Idaho . . . . .	204	—	85	Corn, peas and oats.
Illinois . . . . .	27 000	6 000	50	Corn, soy beans.
Indiana . . . . .	26 000	6 000	—	Corn.
Iowa . . . . .	23 000	1 000	120	Corn.
Kansas . . . . .	11 343	631	100	Corn, kafir, feterita, milo.
Kentucky . . . . .	5 000	1 000	85	Corn.
Louisiana . . . . .	100	—	—	—
Maine . . . . .	3 000	—	—	—
Maryland . . . . .	100	—	—	—
Massachusetts . . . . .	4 257	300	40	Corn.
Michigan . . . . .	10 000	500	80	Corn.
Minnesota . . . . .	16 000	2 500	100	Corn.
Mississippi . . . . .	621	—	100	Corn, sorghum
Missouri . . . . .	10 000	—	—	Corn.
Montana . . . . .	150	40	60	Corn, peas and oats.
Nebraska . . . . .	4 132	—	100	Corn.
Nevada . . . . .	3	—	60	Corn.
New Hampshire . . . . .	2 375	—	—	Corn, millet.
New Jersey . . . . .	1 000	—	75	Corn.
New Mexico . . . . .	50	—	—	—
New-York . . . . .	42 846	4 000	62	Corn.
North Carolina . . . . .	400	50	50	Corn.
North Dakota . . . . .	2 000	150	120	Corn.
Ohio . . . . .	23 000	4 000	70	Corn.
Oklahoma . . . . .	3 000	1 000	75	Cane, milo, feterita.
Oregon . . . . .	1 200	450	55	Corn, oats, and vetch, clover.
Pennsylvania . . . . .	20 000	2 000	50	Corn.
Rhode Island . . . . .	700	60	70	Corn, soy beans.
South Carolina . . . . .	200	62	75	Corn, sorghum.
South Dakota . . . . .	3 000	600	120	Corn.
Tennessee . . . . .	300	—	—	—
Texas . . . . .	450	—	—	—
Utah . . . . .	350	125	90	Corn.
Vermont . . . . .	15 000	500	100	Corn.
Virginia . . . . .	4 000	800	75	Corn
Washington . . . . .	1 900	750	75	Corn, clover, peas, and oats, wheat.
West Virginia . . . . .	5 000	1 000	55	Corn.
Wisconsin . . . . .	55 992	10 000	120	Corn.
Wyoming . . . . .	61	—	70	Corn, alfalfa, oats, and peas.

used, but concrete in its various forms is a close competitor. In Utah, concrete silos are in the majority, while Oregon reports 90 per cent of its silos as constructed of Oregon fir. In Wisconsin, there are about 50 per cent wooden silos, 40 per cent concrete and 10 per cent of tile, or brick. The only thing which appears to direct the selection of the material is the cost of the latter in the different States, for silos made of wood, cement, bricks, or tiles, seem equally efficacious in preserving forage.

Of all the silage crops, corn (maize) is of first importance in every State, except Arizona and Oklahoma, where on account of the climate Kafir (giant millet) and the Japanese sugar-cane are preferred. Several of the southern States use comparatively large quantities of sorghum and cane, while in the southwest, we find kafir and cane, as well as "feterita" and "milo" (two varieties of sorghum) in much favour. Many States report the use of oats and peas, oats mixed with vetch, wheat mixed with vetch, lucerne, millet and sweet clover. In the Northwest, the grain crops are either grown singly, or in combination with vetch, pea or some other leguminosa, while in California, the first cutting of lucerne is frequently ensiled. A few States report the ensiling of rye, but after maize, sweet sorghums or sugar cane are most used.

Soy beans and cow peas (*Vigna Catjang*) are usually combined with maize, or sorghum. In Wyoming, Russian thistles (*Salsola Kali* var. *Tragus*) and beet tops are used for ensilage; while Montana has some experience in ensiling sunflowers. The change from maize to sunflower silage is reported to have had no bad effect upon last year's milk production.

The use of silos on farms is increasing in the United States, and practically every State reports extensive building preparations. In Wisconsin, which is the State most interested in the dairy industry, there is a silo to every third farm, and about 1 silo to 53 head of cattle. Taken as a whole, the United States have apparently 1 silo for every 66 milch cows, or one silo for every 186 head of cattle of all kinds.

285 - **Experiments Made in Germany on the Treatment and Use of Frozen, Beef.** — KALLERT, E., in *Zeitschrift für Fleisch-und Milchhygiene*, Year 26 Part 16, pp. 241-243; Part 17, pp. 259-261; Part 18, pp. 277-280; Part 19, pp. 292-295; Part 20, pp. 309-312. Berlin, 1916.

At the request of "the Zentral-Einkaufsgesellschaft" (Central Purchasing Society) the writer made, in collaboration with Prof. PLANK of Berlin, exhaustive researches on frozen beef. The question was treated both from the standpoint of the wholesomeness of the meat and from that of the technique of the freezing process, but the paper only gives the data relating to the hygienic condition of the meat.

The following points were studied:

1) Freezing.

- 2) Cold storage.
- 3) Loss of weight during this storing.
- 4) Formation of moulds on frozen meat.
- 5) Thawing.
- 6) The use of frozen beef by the pork-butcher.

The researches were carried out in several abattoirs in Germany which were provided with a refrigerating plant, and the necessary conditions were as far as possible obtained.

From the results of these researches, the following principles are deduced as to: The freezing of beef, the storage of frozen meat, the thawing process. The following is a summary of the data obtained:

1) Before being placed in the refrigerating chambers, the meat, after having first been freed from the viscera, should be cooled down to a temperature at least as low as that of the surrounding air. Where there are apparatus for pre-cooling, it is well to keep the meat for some time at about  $+5^{\circ}\text{C}$ .

2) During the freezing process, the quarters should be suspended in such a way as not to touch one another, and so that they can be surrounded on all sides by a strong current of air. After allowing for the space required for passages, the freezing chamber may contain 5 fore-quarters, or 4 hind-quarters, per square metre.

3) The average temperature in the freezing chamber should be kept between  $-6^{\circ}$  and  $-8^{\circ}\text{C}$ . If it is separate from the store, it is not necessary to maintain a definite degree of humidity during freezing. Within the limits of the above-mentioned temperatures, the posterior quarters of 60 kg are completely frozen in 7 days at the longest. It is best to leave the very fat quarters for 1 day more, as the fat layer has a very marked isolating effect.

In the case of hind-quarters of over 60 kg, the length of time required for freezing increases 3 per cent for every 10 per cent increase in weight. Conditions being otherwise equal, the fore-quarters freeze in 25 per cent shorter time than the hind-quarters.

4) Freezing and cold storage can be effected by means of refrigerating pipes alone, or by using them in combination with a cold air pipe.

In the latter case, it is sometimes necessary to increase the current of air by means of a ventilator placed in the ceiling. The refrigerating pipes should, if possible, run above the passages, and care must be taken not to allow hoar-frost to remain upon them. Hoar-frost should also not be permitted to fall upon the meat.

5) The freezing and the cold storage ought, if possible, to be carried out in different places. Should the local condition necessitate the beef being frozen in the store, the successive consignments of meat must be limited, so that the temporary rise in temperature does not exceed  $-3^{\circ}\text{C}$ . The frozen meat in this case should be stacked near the inflow pipe where the air is driest and coldest, while the meat to be frozen ought to be hung near the exhaustion pipe.

6) Only completely frozen meat should be stacked, therefore covering the quarters should be avoided.

As it is necessary for the meat to be surrounded by a current of air, the stacks should not be piled too closely.

In order to facilitate this aeration, laths of wood projecting about 10 cm are laid on the floor of the store; sufficient space is left between the walls and the meat, while



wide passages are left between the stacks; these are indispensable in order to allow of the frequent examination of the meat. With the system of freezing by means of the air alone, and provided the air circulates everywhere in a uniform manner, as much as 500 kg. of meat can be stacked per net cubic metre. If the combined system is used, it is advisable not to stack more than 400 kg. per cubic metre. The stacks may be 2.5 to 3 metres in height, and the top should reach to about 0.5 metre below the inflow air pipes, the latter being provided with openings directed downwards.

7) The temperature of the store should be, at most,  $-8^{\circ}$  to  $-10^{\circ}$  C., or even less. Changes of temperature are, as much as possible, to be avoided, therefore the pauses in the work should recur at regular intervals.

The optimum degree of relative humidity measured by a psychrometer provided with an aspirator, is from 90 to 92 per cent, within the above-mentioned limits of temperature.

8) The stored meat must be frequently examined, and a look out kept for any formation of colonies of moulds. If the meat is long stored, it is necessary to take down the stacks, and examine the quarters that have been out of sight. This is indispensable, if there is any formation of moulds on the meat.

Before continuing the work, the moulds should be removed with a knife.

9) When the beef is thawed, the quarters must be kept whole and not divided. If before this operation, any formation of moulds is observed, the fungi must be removed with a wet, or dry cloth, or better still, with a knife. In order to avoid any useless loss of juices owing to too rapid thawing, and, at the same time, to prevent the undue prolonging of this operation, it is well to carry it out at an average temperature of between  $+5$  and  $+6^{\circ}$  C. When it is possible to regulate both the temperature and the humidity of the thawing chamber, the thawing operation should begin at  $0^{\circ}$  and at 70 per cent relative humidity; then the temperature should gradually be raised to from  $+10^{\circ}$  to  $+12^{\circ}$  and the humidity to 90 per cent.

At the above-mentioned temperatures, hind-quarters weighing 60 kgs take about 80 hours to thaw, while fore-quarters of the same weight are thawed in about 65 hours. In the case of heavier quarters, the length of time needed for thawing increases 3 per cent for every 10 per cent increase in weight. Meat thus thawed can be kept without injury in cold chambers for at least 8 to 10 days after thawing, and at the usual temperatures,  $+2^{\circ}$  to  $+4^{\circ}$  C; the relative humidity being from 75 to 80 per cent.

## 286 - Meat Production and Trade in the United States and Other Countries.

— HOLMES, GEORGE, K., in *United States Department of Agriculture, Office of the Secretary, Report No. 109*, pp. 1-307, Washington, July 3, 1916.

The United States is the most prominent nation in the production and consumption of meat. Nevertheless, here, as in most other countries, the cattle are hardly increasing in number, sheep are declining and swine are increasing. If comparison be made with increasing population, sheep are far from maintaining their numbers, in some small degree cattle are failing to do so, but in the case of swine, there has been some gain above population in recent years, although a small one.

The number of cattle in 1907 was 72 534 000; it fell to 56 500 000 in 1913, but there was a perceptible increase in 1916 when it was estimated at 61 441 000.

The number of sheep has fallen from 52 500 000 on April 15, 1910, to 49 200 000 in 1916. The swine have increased from 58 200 000 on April 15, 1910, to 68 000 000 in 1916.

The countries producing much surplus meat are Argentina, Australia, Canada, Denmark, Mexico, New Zealand, the United States and Uruguay. There are other countries that have a relatively small surplus, Paraguay and Madagascar for instance, and many others which export relatively little, while importing more, for example, Germany and Italy.

Substantially, the world's export trade in meat and meat products is maintained by 9 countries. The total of these exports for these countries reached their highest amount, 3 861 000 000 lbs, in 1912. This great quantity, after deducting about 500 000 000 lbs, for mutton, was divided between beef and pork in the ratio of about 52 per cent for beef and 48 per cent for pork, which latter figure shows a tendency to rise.

The export trade of the 9 surplus countries only amounted, in 1912, to about 7.7 per cent of the production of the whole world (without China), which is estimated at about 50 000 000 000 lbs. Argentina and Uruguay together exported 36 per cent of the world's export of meat and meat products in 1912; the United States 31.1 per cent; Australia and New Zealand combined 18.7 per cent; and these three great export sources provided 90 per cent of the world's total. In 1912,  $\frac{3}{5}$  of the world's export trade in beef and its products belonged to Argentina, about  $\frac{1}{5}$  to the Australasian Colonies and  $\frac{1}{7}$  to the United States:  $\frac{3}{4}$  of the exports of pork and pork products go from the United States, about  $\frac{1}{5}$  from Denmark and about  $\frac{1}{20}$  from Canada. The mutton export trade is mostly confined to the two Australasian colonies and to Argentina, the former contributing  $\frac{3}{4}$  and the latter  $\frac{1}{4}$ .

The United Kingdom is the most prominent meat-importing country and in normal times obtained from surplus countries about 40 per cent of its consumption. Germany held the second place, mostly because of fats and oils, and for the same reason Holland held the third place. In 1913, the United States became the fourth importer of meat and meat products among the importing countries, but these imports are mostly chilled and frozen beef, with some mutton from South America and Australasia.

Meat and its products only represent a very small part of the calories consumed by the world's peoples, for vegetable products, cereals, sugars and fats must be taken into account. A few countries, comparatively, consume the bulk of the world's meat, and the chief of these, the United States, is also the principal producer.

The total meat production of the United States in 1900, was estimated at 16 226 000 000 lbs and in 1909 it reached 16 940 000 000 lbs. If the extra-edible parts are added, these figures would amount to 18 865 000 000 lbs for 1900 and 19 712 000 000 lbs for 1909.

In 1900, the mature cattle slaughtered in the United States were 46.1 per cent. of the stock of cows, and in 1910, 42 per cent. The sheep slaughter, in 1900, was 44.9 per cent. of the stock of ewes, and in 1910, it was 46.1 per cent. In 1900, the slaughtered swine were 79.8 per cent of the total stock of swine on hand, and 76.9 per cent in 1910.

If the total meat production is divided among the 500 millions of persons who usually consume this form of food, the per capita average is 93.3 lbs per year.

In the United States, the amount per capita was 181.5 lbs in 1900, and 170.6 in 1909. This is by far the highest consumption per head, except in Australia and New Zealand, where it amounted to 263 and 212 lbs respectively.

The total consumption of meat and meat products in the United States in 1900, is estimated at 13 792 000 000 lbs and in 1909 at 15 450 000 000 lbs. In 1913, Germany consumed 7 399 000 000 lbs, Russia (without Poland) 6 024 000 000 lbs in 1899, the United Kingdom 5 174 000 000 lbs in 1906, and France 3 096 000 000 lbs in 1904. In 1914 and 1915, the United States imported 2.6 and 2.7 per cent respectively of their total beef and mutton consumption including calves. The surplus of all the meat and meat products in the United States was 917 000 000 lbs in 1914 and in 1915.

The losses of meat animals in the United States from disease and exposure are enormous. Since 1900, from 1 100 000 to 1 475 000 cattle have been lost from disease annually and from about 600 000 to 1 500 000 cattle have been lost annually from exposure since 1889. Sheep losses from disease have been about the same as cattle, while the swine losses have varied from a minimum of 2 200 000 head in 1894, to a maximum of 7 000 000 in 1914; they were mainly due to hog cholera.

The prices which have been compiled for producing and consuming countries show an upward trend of prices of meat and meat products. The few exceptions that have been observed are inconsiderable, and indicate that in these instances the country is, for some special reason, unaffected by the world-wide conditions that are so prominently verified in these price compilations.

The general fact is that meat production has not kept pace with the increase of population and the consumers' demand. The inevitable measure of this changed relationship is price. Increasing cost of meat production is a factor in the rise in prices. The United States are not alone in the decline of meat production per head, but are participating in a world-wide movement.

A careful study has been made of the conditions of the Chicago market; the resulting report contains comparisons between the average prices paid from 1893-1897 and those given in 1914 for animals bought



at the farm and at the Chicago market respectively. Cattle, sheep and swine are included.

In the preparation of this report, a separate study was made of meat-producing conditions in 13 countries: Argentina, Australia, Brazil, British South Africa, Canada, Chile, Colombia, Denmark, Madagascar, Mexico, New Zealand, Paraguay and Uruguay. The assembled facts indicate that gradually and at some indefinite future time, Southern Brazil may rival Argentina in meat production; Mexico should eventually produce millions of cattle yearly, Argentina and Uruguay could greatly increase their beef production and Paraguay may follow. Climatic and hydrographical conditions present formidable obstacles to further extension of cattle and sheep rearing in Australia, but to some extent, they may gradually be overcome. Rhodesia has an extensive range area that will yet produce great numbers of cattle and there are other parts of British South Africa which could largely increase their production.

Further, in many places, sheep may undergo a change from almost exclusive wool production to a production of mutton and lamb as well, or perhaps to the subordination of wool.

In Canada, the extension of meat production is increasingly a problem of farm management.

An extraordinary combination of circumstances and factors in all countries, or even in a considerable number of them, to cause a rapid increase of the production of meat is not to be expected, rather, as a net result, gradual growth and extension which may, or may not, equal the rate of increase of the meat-eating population.

The value of cattle, sheep and swine on farms and ranges in the United States on January 1, 1916, was over \$ 3 332 000 000.

The value of the farms and farm property with live stock as a principal source of income in 1910 was over \$ 15 000 000 000. The value of the capital of whole-slaughtering, and meat-packing, lard-refining and oleomargarine establishments in 1910 was over \$ 338 000 000.

In 1910, 32.4 per cent of the population of the United States was agricultural, this proportion was 77.5 per cent in 1840, 47 per cent in 1870, 39 per cent in 1890 and 35 per cent in 1900.

Agricultural labour, as devoted to production of crops, has in these last decades, gained greatly in effectiveness by means of improved machinery, implements and processes. This permits of a relative decline in the agricultural population, as far as crop production is concerned, but it is a question whether this applies in the same degree to meat-animal production. The consumption of crops per head has long increased and the consumption of meat per head has decreased. The displacement of meat in the dietary by products of the vegetable kingdom advances slowly but surely in the United States.

The report contains 30 Tables of statistics and 32 diagrams.

287. — **The Great Cattle Markets of the United States.** — POOLE, JAMES E., in *The Field*, Vol. XXVI, No. 12, pp. 1015-1016 and 1082, New York, December, 1916.

The four principal cattle markets of the United States are Chicago, Kansas City, Omaha and St. Louis. The principal distributing markets are: St. Joseph, Mo., Oklahoma City, Sioux City, St. Paul Minn. and Fort Worth.

The annual traffic of the United States' markets amounts to about 1 million trucks of cattle, sheep and pigs. This figure does not include the return traffic from the markets to the fattening centres. The traffic in cattle is, therefore, enormous. Texas, for example, annually sends half a million head of cattle to the north, chiefly to the pasture-lands of Kansas, Oklahoma, Montana, Wyoming and South Dakota. In autumn the pasture-lands of Kansas feed the fattening stock of Missouri and Illinois, and even include that of Pennsylvania, New York State and Virginia. The two Dakota states, Nebraska and Montana send millions of grazing cattle to the maize district. Between September and December innumerable animals come to the central and eastern states from the breeding-centres of Idaho, Montana and Wyoming to build up the herds. The cattle traffic is the chief source of revenue of many of the western railways.

The appended table shows the number of animals which passed through the principal markets of the United States in 1915, and gives a résumé of the figures for the preceding years.

These enormous markets have their drawbacks, but, nevertheless, they are looked upon as the indispensable clearing-houses of a great industry. On these markets business is transacted daily for payment in cash. The market of Chicago alone brings to the producers an annual profit of over £ 80 000 000, and the same may be said of the markets of Kansas City and Omaha. Every market is run by private firms who make their profits by letting stables, feeding the animals and transport work; for example the firm of Morris controls the markets of St. Louis and Kansas City, the firm of Swift those of St. Joseph and St. Paul, Armour and Swift those of Fort Worth, Sioux City and Denver. The principal markets of the east are controlled by the railway companies. Since the introduction of the refrigerating industry, slaughtering has, for economic reasons, become more and more concentrated in these market centres which offer the buyer the advantage of the largest selection. There is always great competition between these large markets, for purchasers flock to them from New York, Boston, Philadelphia, etc., and it not infrequently happens that regular campaigns are started between the six principal slaughtering and refrigerating firms, for in the United States there are at least 100 other firms, which, though less powerful, represent in themselves a formidable competitive element in the large markets.

*Number of Slaughter Animals which passed through the Principal Markets of the United States in 1915 and the Preceding Years.*

Market	Cattle	Pigs	Sheep
Chicago . . . . .	2 262 752	7 652 071	3 510 015
Kansas City . . . . .	1 860 235	2 530 730	1 814 683
Omaha . . . . .	1 218 342	2 643 973	3 268 279
St. Louis . . . . .	991 709	2 591 759	648 142
St. Joseph . . . . .	405 852	1 697 842	877 930
Sioux City . . . . .	511 783	1 760 818	337 079
St. Paul . . . . .	712 918	2 155 201	704 111
Indianapolis . . . . .	273 212	2 435 319	112 773
Buffalo . . . . .	236 102	1 805 744	835 128
Milwaukee . . . . .	99 434	583 071	85 837
Driver . . . . .	395 922	343 653	765 170
Fort Worth . . . . .	794 505	463 879	363 003
Oklahoma City . . . . .	201 968	484 842	68 729
Wichita . . . . .	153 035	879 469	29 604
Total 1915 . . . . .	10 117 769	27 627 371	13 410 483
Total 1914 . . . . .	9 657 042	24 173 384	15 683 030
Total 1913 . . . . .	10 746 965	27 083 756	17 641 278
Total 1912 . . . . .	10 588 053	26 562 171	17 909 965
Total 1911 . . . . .	10 860 533	27 273 291	17 495 576

The contracts drawn up in each market are controlled by two organisations: the "Live Stock Exchange", which acts on behalf of the producers, and the "Trader's Exchange", which acts on behalf of the traders, and for its own benefit. This latter organisation is composed of traders and speculators who, as a rule, specialise in one particular variety of stock.

The control of the commission markets is in the hands of the Chicago "National Live Stock Exchange", which is made up of various local exchanges.

The central cattle market fulfills a necessity. Theoretically, cattle should be slaughtered near the centre of consumption, but, practically, this is impossible in the United States. Under these conditions the economy of centralisation is obvious, and, so long as most of the consumers are to the east of Chicago while the greater part of the cattle, pigs and sheep for consumption are produced in the west, the central market with its huge side industries will have a legitimate economic function.



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## PLANT DISEASES

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### GENERAL INFORMATION.

288 - Decree of the Italian Minister of Agriculture, Prohibiting the Export of Various Plants and Parts of Plants. — *Gazzetta Ufficiale del Regno d'Italia*, Year 1917, No. 5, pp. 81-82. Rome, January 8, 1917.

Under date of December 8, 1916, the Minister of Agriculture, seeing the necessity of preventing the further diffusion in the Kingdom of plant diseases, at present limited to certain zones, published the following decree, which came into force on January 9, 1917:

Art. 1. — The export is prohibited of:

a) cuttings or rooted cuttings of vines from districts declared to be infected with "bramble-leaf" ("arricciamento" or "roncet".)

b) chestnut trees from districts declared to be infected with "ink disease";

c) seeds of forage leguminosae, or flax, from districts declared to be infected with dodder.

d) almond, or pear trees from districts declared to be infected with *Aonidiella inopinata* (*A. robusta*).

Art. 2. — On the proposal of the Delegate of the Phytopathological Service, and by the decree of the Minister of Agriculture, the boundaries of the infected area shall be determined and the destructive, or curative, measures to be adopted according to the cases (Art. 22 of the regulation of March 12, 1916, No. 723). (1).

Art. 3. — The delegate of the Phytopathological Service may not grant certificates of immunity, according to article 8 of the above-mentioned regulation, for the plants mentioned in article 1. of the present decree, which are cultivated within the limits of the area declared to be infected.

LEGISLATIVE  
AND  
ADMINISTRATIVE MEASURES  
FOR THE  
PROTECTION  
OF CROPS.

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(1) The Statute providing for the execution of the law of June 1913, No. 888, dealing with the measures for the Prevention and Control of Plant Diseases in Italy. See *B. August 1913*, No. 995. (Ed.)

Art. 4. — The delegates of the Phytopathological Service are required to sequester plants, or portions of plants, offered for sale or supplied for propagating purposes, if they are infected with any of the diseases enumerated in Art. 1. of the present decree, or with any of the following diseases:

a) cuttings, rooted cuttings, or woody plants infected with "root-rot", "gummosis", or "canker";

b) saplings or trees of Canada poplar infected with *Dothichiza populea*. (Poplar canker);

c) rhizomes, or off-set shoots of asparagus infected with *Zopfia rhizophila*;

d) plants, or rooted cuttings, and cuttings attacked by the scale insect (*Ceroplastes sinensis*);

e) all parts of citrus, and other trees with persistent leaves, attacked by one of the following scale insects: *Icerya purchasei*, *Parlatoria zizyphi*, *Chrysomphalus dictyospermi*, *Aonidiella aurantii*;

f) trees, or saplings, and cuttings attacked by *Diaspis pentagona*;

g) apple trees attacked by the Woolly aphis (*Schizoneura lanigera*).

Art. 5. — The directors of the regional observatories, after having satisfied themselves of the presence of any one of the diseases mentioned in Art. 4 of the present decree, shall inform the persons interested of the measures of cure, or of disinfection, to be used for a prescribed length of time. If the person interested does not disinfect, or carry out the treatment for the time prescribed, the Director of the regional observatory shall inform the Ministry, which shall proceed according to Art. 22 of the Statute already mentioned.

Art. 6. — The certificate of immunity may not be granted for the respective species of plants, in nurseries, horticultural establishments, or gardens where plants are grown for sale, if the presence there has been certified of any one of the diseases enumerated in Art. 4 of the present decree.

The prohibition will be withdrawn when it has been ascertained that the disease has disappeared in consequence of the application of the treatment prescribed by Art. 5 of the present decree.

289 — **The Phytopathological Inspection of Horticultural and Vine-Growing Establishments Considered as a Factor of Increased Exportation, in France.** — *Feuille d'informations du Ministère du Commerce, de l'Industrie, de l'Agriculture, du Travail, des Postes et des Télégraphes*, Year 22, No. 5, p. 4. Paris January 30, 1917.

The number of horticultural and vine-growing establishments subject to phytopathological inspection is increasing every year.

While there were 83 in 1914, the number increased to 103 in 1915, and to 132 in 1916.

The large increase in the value of the plants and vines exported to countries requiring phytopathological certificates, in spite of the present condition of affairs, is also worthy of note

In 1914, the value of the exports was 1,464,986 francs; in 1915, it was 2,466,110 fr.; and in 1916, 3,447,900 fr.

It is to be foreseen that these exports will continue to increase, thanks to the health certificates offered by the French Government to the importing countries, which are thus able to introduce plants with perfect confidence, knowing them to be certified as free from all injurious parasites.

The establishments under State control were divided, in 1916, into 14 districts, and the inspection of the crops was undertaken by 26 entomologists and cryptogamists under the direction of Dr. MARCHAL, a member of the Institute, and Director of the Paris State Entomological Station.

In accordance with the decree of February 1915 organising the Phytopathological Service, (1) exporting nursery-gardeners receiving health certificates are required to defray the expenses of the Service; in 1916, they paid, in addition to a fixed annual tax of 25 fr., a tax of 1 fr. 55 per 1000.

## DISEASES NOT DUE TO PARASITES OR OF UNKNOWN ORIGIN.

290 - "False Blossom", a Disease of Cranberry (*Oxycoccus macrocarpus*) in the United States of America. (2) — SHEAR, C. L. in *The United States Department of Agriculture, Bulletin* 444, 8 pp. 2 fig., 4 pl., Washington, D. C., 1916.

One of the most important characteristics of the disease of *Oxycoccus macrocarpus*, commonly known in Wisconsin as "false blossom", is the deformation or metamorphosis of the floral organs. In the simplest form of deformation the floral pedicels are seen to become more or less erect instead of curving, and the lobes of the calix become enlarged and turn greenish and somewhat leaf-like; the petals become shorter and broader and slightly reddish or greenish in colour; the stamens and the pistil seem more or less abortive or deformed; fruit is not produced.

(1) See B, April 1915, No. 438.

(2) See also B., April 1916, No. 470.

(Ed.)



As a rule all the intermediate stages of deformation may be found in plants attacked by the disease, from the simple form in which only a shortening and broadening of part of the perianth is produced, to the form in which the whole flower is replaced by a short branch with small leaves. In certain cases the various floral organs may be represented by whorls of green bodies, resembling leaves, and arranged on elongated axes. Diseased plants also tend to develop lateral branches by means of axillary buds, usually in the latent state and situated beneath the fruit bud. The branches are thin and weak and produce neither normal flowers nor fruit. This gives the plant the same appearance as plants attacked by "witch's broom". In certain cases the extremity of the floral branch continues to develop and produces a long, thin shoot, instead of bearing a fruit bud for the subsequent season, as is the case with normal plants. In swampy ground, where this deformity usually occurs, the plants of *O. macrocarpus* show an excessive vegetative growth and generally produce a deep, dense mass of branches. In the latent state the terminal buds often become enlarged and abnormal and die during the winter. Under these conditions they produce few branches, all of which are long and thin.

The disease in question seems to have made its first appearance in Wisconsin, but, with the introduction from Wisconsin of diseased *Oxycoccus*, it has started to spread through Massachusetts, New Jersey, Oregon and Washington State. The cause of the disease is unknown; up to the present there is nothing to prove that it is due either to insects or fungi. It has been suggested that the deformity may originate in serious disorders of the nutritive functions of the plant.

The disease is perpetuated from one year to another by plants vegetatively reproduced from diseased plants, not only in swampy ground where the deformity has already appeared, but even under rather more favourable conditions of cultivation and in districts where the disease was previously unknown.

From observations carried out in Wisconsin and Oregon it seems that shoots of plants attacked by "false blossom" tend to recover and become normal if they are transplanted and cultivated under favourable conditions of soil and moisture.

To cure the disease the plant must be given the maximum conditions favourable to its development, including good drainage, freedom from weeds and careful pruning. If the diseased plants are numerous, the ground should be cleared and healthy *Oxycoccus* plants put in.

In order to avoid subsequent spreading of the disease it is wise to plant only samples of *Oxycoccus* which are known to be absolutely free from the deformity described.

291 - **The Defective Development of Walnut Shells in Austria.** — LINS-BAUER, L., in *Zeitschrift für Pflanzenkrankheiten*, Vol. 26, Part 8, pp. 449-451. Stuttgart, January 15, 1917.

Last autumn, in the district of Klosterneuburg, the writer found some fruits of *Juglans regia* which were distinguished by a more, or less, defective development of the shell. The latter was not of the same thickness throughout, and in some parts, it was very thin. On studying this anomaly carefully, the writer found that it was a question of the same phenomenon to which MEMMLER (in *Die Gartenwelt*, Part 53, 1915) and OBERSTEIN (in *Centralblatt für Bakteriologie, Parasitenkunde und Infektionskrankheiten*, Part 2, Vol. 45, Nos. 18-25) had already drawn attention.

As these two scientists had given a description of the defective shells, the writer only deals with some characteristic points which have not hitherto been mentioned.

In the fruits examined, the abnormal growth did not always occur on both sides of the suture of the shell; the latter was often badly developed only on one side.

The thin portion was, however, in every case nearer the apex than the base of the nut. It frequently happens that these abnormal walnuts are attacked by birds which remove the kernel.

Although this abnormality is very common, no explanation of it is to be found in phyto-pathological literature. It has been observed, however, for a long time. The writer is of opinion that MEMMLER's and OBERSTEIN's hypothesis as to its origin is incorrect.

The latter observers attribute the unequal thickness of the walnut shell to the unfavourable climatic conditions obtaining in 1915, when they consider this defect occurred for the first time. It is true that certain conditions of climate and of soil have some effect, but the abnormality is chiefly due to an inherent characteristic of the variety. Walnuts which generally have thin shells, are more subject to this unequal development than those with thick shells.

In conclusion, the writer remarks that this abnormality in the walnut is perhaps analogous to that occurring frequently in apricots, almonds and cherries.

# DISEASES DUE TO FUNGS, BACTERIA AND OTHER PLANTS.

DISEASES  
OF VARIOUS  
CROPS.

292 - **Host Plants of *Thielavia basicola* (1).** — JOHNSON, JAMES, in *Journal of Agricultural Research*, Vol. VII, No. 6, pp. 289-300, pl. 18-19. Washington, D. C., 1916.

From 1850 to 1916, different workers have recorded, in Europe and America, the following 39 plants as hosts of the ascomycete, *Thielavia basicola* Zopf.

Araliaceae . . .	<i>Aralia quinquefolia</i>	Leguminosae . . .	<i>Phaseolus multiflorus</i>
Begoniaceae . . .	<i>Begonia rubra</i>	» . . .	<i>Ph. vulgaris</i>
» . . .	<i>Begonia (tuberhybrida?)</i>	» . . .	<i>Pisum sativum</i>
Bignoniaceae . . .	<i>Catalpa speciosa</i>	» . . .	<i>Trifolium hybridum</i>
Chenopodiaceae . . .	<i>Beta vulgaris</i>	» . . .	<i>T. pratense</i>
» . . .	<i>Aster sp.</i>	» . . .	<i>T. repens</i>
» . . .	<i>Senecio elegans</i>	» . . .	<i>Trigonella coerulea</i>
Compositae . . .	<i>Scorzonera hispanica</i>	» . . .	<i>Vigna sinensis</i>
Cucurbitaceae . . .	<i>Citrullus vulgaris</i>	Malvaceae . . .	<i>Gossypium herbaceum</i>
Cruciferae . . .	<i>Capsella Bursa-pastoris</i>	Umbelliferae . . .	<i>Apium graveolens</i>
» . . .	<i>Cochlearia Armoracia</i>	» . . .	<i>Daucus Carota</i>
Cyperaceae . . .	<i>Blysmus compressus</i>	» . . .	<i>Pastinaca sativa</i>
Hydrophyllaceae . . .	<i>Nemophila auriculata</i>	Orchidaceae . . .	<i>Cypripedium sp.</i>
Leguminosae . . .	<i>Lathyrus odoratus</i>	Oxalidaceae . . .	<i>Oxalis corniculata</i> var.
» . . .	<i>Lupinus albus</i>		<i>stricta</i>
» . . .	<i>L. angustifolius</i>	Primulaceae . . .	<i>Cyclamen sp.</i>
» . . .	<i>L. luteus</i>	Scrophulariaceae . . .	<i>Linaria canadensis</i>
» . . .	<i>L. Thermis</i>	Solanaceae . . .	<i>Nicotiana rustica</i>
» . . .	<i>Medicago sativa</i>	» . . .	<i>N. Tabacum</i>
» . . .	<i>Onobrychis Crista-galli</i>	Violaceae . . .	<i>Viola odorata</i>

The results given in this study were obtained from experiments carried out almost exclusively in greenhouses partly at Arlington (Virginia) and partly at Madison (Wisconsin). The soil used was either taken from tobacco fields badly infected with *T. basicola*, or else mixed with such soil, in order to corroborate the statements of earlier investigators.

With the exception of seven species already mentioned as hosts of the fungus:

<i>Begonia rubra</i>	<i>Lupinus angustifolius</i>
<i>B. (tuberhybrida?)</i>	<i>L. Thermis</i>
<i>Blysmus compressus</i>	<i>Cypripedium sp.</i>
<i>Nemophila auriculata</i>	

(1) See also *B. March* 1911, No. 1004; *B. January* 1912, No. 234; *B. May* 1912, No. 861; *B. January* 1913, No. 71; *B. May* 1913, No. 520; *B. July* 1913, No. 805; *B. September* 1913 No. 1108; *B. June* 1916, No. 699.



which could not be experimented upon, on account of the difficulty in procuring these plants, or their seeds, the other 32 were cultivated, and on 25 of them the fungus was found. These plants are:

<i>Aralia quinquefolia</i>	<i>Pisum sativum</i>
<i>Catalpa speciosa</i>	<i>Trifolium hybridum</i>
<i>Aster</i> sp.	<i>T. pratense</i>
<i>Senecio elegans</i>	<i>T. repens</i>
<i>Citrullus vulgaris</i>	<i>Trigonella coerulea</i>
<i>Capsella Bursa-pastoris</i>	<i>Vigna sinensis</i>
<i>Cochlearia Armoracia</i>	<i>Gossypium herbaceum</i>
<i>Lathyrus odoratus</i>	<i>Oxalis corniculata</i> var. <i>stricta</i>
<i>Lupinus albus</i>	<i>Cyclamen</i> sp.
<i>L. luteus</i>	<i>Linaria canadensis</i>
<i>Medicago sativa</i>	<i>Nicotiana Tabacum</i>
<i>Onobrychis Crista-galli</i>	<i>Viola odorata</i>
<i>Phaseolus vulgaris</i>	

Infection could not be obtained upon the following plants:

<i>Beta vulgaris</i>	<i>Daucus Carota</i>
<i>Scorzonera hispanica</i>	<i>Pastinaca sativa</i>
<i>Phaseolus multiflorus</i>	<i>Nicotiana rustica</i>
<i>Apium graveolens</i>	

The above should be excluded from the list of hosts of *T. basicola*, until further corroboratory evidence of infection is obtained.

As the experiments with infected soil were carried out upon a large number of other plants, including those most usually grown, and belonging not only to the families already mentioned, but also to others (*Gramineae*, *Liliaceae*, *Linaceae*, *Rosaceae*, *Urticaceae*, etc.) it was possible to add 66 new species to the plants already reported and corroborated as host plants of *T. basicola*. These are:

Begoniaceae . . .	<i>Begonia semperflorens</i>	Leguminosae. . .	<i>Trifolium incarnatum</i>
Convolvulaceae. . .	<i>Ipomoea coccinea</i>	» . . .	<i>Trigonella Foenum graecum</i>
Cucurbitaceae . . .	<i>Cucumis acutangulus</i>	» . . .	<i>Ulex europaeus</i>
» . . .	<i>C. flexuosus</i>	» . . .	<i>Vicia Faba</i>
» . . .	<i>C. sativa</i>	» . . .	<i>V. villosa</i>
» . . .	<i>Cucurbita maxima</i>	Orchidaceae . . .	<i>Paphiopedilum Grossianum</i>
» . . .	<i>C. Melo</i>	Papaveraceae. . .	<i>Papaver nudicaule</i>
» . . .	<i>C. moschata</i>	Polemoniaceae . . .	<i>Phlox Drummondii</i>
» . . .	<i>C. Pepo</i>	Portulacaceae . . .	<i>Portulaca oleracea</i>
Hydrophyllaceae .	<i>Nemophila aurita</i>		
» . . .	<i>N. insignis</i>		

Leguminosae. . .	<i>Arachis hypogaea</i>	Scrophulariaceae .	<i>Linaria Cymbalaria</i>
» . . .	<i>Astragalus sinicus</i>	» . . .	<i>L. maroccana</i>
» . . .	<i>Cassia Chamaecrista</i>	Solanaceae . . .	<i>Datura cornucopia</i>
» . . .	<i>Cytisus scoparius</i>	» . . .	<i>D. Metel</i>
» . . .	<i>Desmodium tortuosum</i>	» . . .	<i>D. Stramonium</i>
» . . .	<i>Dolichos Lablab</i>	» . . .	<i>D. Tatula</i>
» . . .	<i>Galactia</i> sp.	» . . .	<i>Nicotiana alba</i>
» . . .	<i>Glycine hyspida</i>	» . . .	<i>N. angustifolia</i>
» . . .	<i>Lens esculenta</i>	» . . .	<i>N. atropurpurea</i>
» . . .	<i>Lespedeza striata</i>	» . . .	<i>N. calyciflora</i>
» . . .	<i>Lotus corniculatus</i>	» . . .	<i>N. chinensis</i>
» . . .	<i>L. villosus</i>	» . . .	<i>N. glauca</i>
» . . .	<i>Lupinus hirsutus</i>	» . . .	<i>N. glutinosa</i>
» . . .	<i>Medicago denticulata</i>	» . . .	<i>N. Langsdorfii</i>
» . . .	<i>Melilotus alba</i>	» . . .	<i>N. laterrima</i>
» . . .	<i>M. indica</i>	» . . .	<i>N. longiflora</i>
» . . .	<i>Onobrychis viciaefolia</i>	» . . .	<i>N. macrophylla</i>
» . . .	<i>Ornithopus sativus</i>	» . . .	<i>N. repanda</i>
» . . .	<i>Phaseolus acutifolius</i>	» . . .	<i>N. Sanderæ</i>
» . . .	<i>Robinia Pseudoacacia</i>	» . . .	<i>N. silvestris</i>
» . . .	<i>Scotus chinensis</i>	» . . .	<i>Petunia (hybrida?)</i>
» . . .	<i>Strophostyles helvola</i>	» . . .	<i>Solanum carolinense</i>
» . . .	<i>Tephrosia virginiana</i>	Violaceae . . .	<i>Viola tricolor</i>

It results from the above lists that the plants primarily attacked by *T. basicola* are members of the *Leguminosae*, *Solanaceae*, and *Cucurbitaceae*; the other families mentioned contain few hosts of this fungus. The writer's experiments also showed that a great difference exists in the susceptibility of the various species, and that where earlier workers have been inclined to doubt the parasitism of *T. basicola*, it appears to have been due to the fact that infection experiments were carried on with what now are known to be immune, or very resistant, plants.

Although Messrs. MASSEE and ROSENBAUM have recorded the occurrence of *T. basicola* in certain cases on stems above the surface of the ground, this is but rarely observed. Ordinarily, according to the writer, infection occurs only on the roots of the host plant, or upon the base of the stem just at, or below, the surface of the soil.

Other observations were made in the course of these experiments as regards the fructifications of the parasite.

The conidial spore form is only rarely seen on the living host, although it is produced early and abundantly in culture medium. The size, shape, number, and colour of the chlamydospores produced upon the various hosts differed to some extent. These differences appear to be determined in part by the location of these spore chains, that is to say, whether they are formed inside, or outside the cells of the host plant.

Many workers have questioned the connection of the perithecia as described by ZOPF with the chlamydospores of *T. basicola*. The association of the perithecia upon a large number of the different host plants observed in these tests with the chlamydospore stage of *T. basicola* is fairly convincing as to the connection, maintained by ZOPF, of the ascophore form with the chlamydospore of *T. basicola*.

The infection of nearly 100 different species of plants with *T. basicola* from tobacco is further evidence that no specialised races of this fungus appear to exist.

293 - *Chalaropsis thielavioides* n. g. and n. sp. a Parasite of the White Lupin in Latium.—PEYRONEL, BENIAMINO, in *Le stazioni sperimentali agrarie italiane*, Vol. XLIX, Part II, pp. 583-596, fig. 1-5, Pl. II-VI, Modena, 1916.

A description of a disease of the stem and roots of *Lupinus albus* observed in 1915, at Velletri, Genzano, and Albano, and which also occurred in 1916, in Rome. This disease may have been previously noticed, but probably it was confused with the root rot due to *Thielaviopsis basicola*, the conidial form of *Thielavia basicola*.

There first appear at the base of the stem in the hypocotyl region, or near the scars left by the cotyledons and the first leaves that have fallen, elongated, reddish-brown patches. These gradually extend and finally occupy the whole base of the stem, the affected portion appearing almost as if charred.

Soon the epidermis of the diseased zone splits and numerous longitudinal cracks appear, and if the air is very damp, a great mass of white powder is produced, the greater part of which falls upon the previously-formed brown patches and conceals them. Later, if the season again becomes dry, this white powder disappears, and the base of the stem is then covered with a more or less abundant black powder. From the stem the disease can proceed to the root system.

In the end, the youngest and weakest plants attacked become bent to the ground and then wither and die. The better developed individuals, on the other hand, do not appear to suffer greatly, and unless, as often happens, secondary diseases supervene, which are due to *Fusarium vasinfectum* or *Sclerotinia Libertiana*, and are greatly promoted by the numerous rents produced by the disease in the epidermis of the lupin, the plants may flower and produce normal seed.

The disease in question is caused by a fungus described under the name of *Chalaropsis thielavioides* by the writer, who thus makes a genus and species new to science.

This parasite has a hyaline, or sub-hyaline, septate, and ramified mycelium giving rise to macroconidia (or chlamydospores), and to microconidia.



The former are brown, with very thick walls, and occur at the end of the short, lateral ramifications of mycelium into which they are directly inserted.

It is the macroconidia and also the dead tissues which, seen through the epidermis of the host plant, produce the above-mentioned brown patches. According to the writer, the macroconidia, which seen in mass look like black powder, serve to preserve the species when the environmental conditions are unfavourable, and especially when the humidity necessary for the normal development of the fungus is wanting.

The hyaline and delicate microconidia, on the other hand, develop within superficial conidiophores whence they emerge united together in short chains. It is these microconidia which form the white powder observed on the infected portions of the stem. In the writer's opinion, their function is to reproduce the species when the conditions are favourable.

This fungus can be grown, both from macroconidia and microconidia, with the greatest ease on artificial media. The writer draws attention to the fact that, in all probability, it can develop equally well under saprophytic, or parasitic, condition. Numerous artificial infection experiments carried out on young plants of *Lupinus* grown in pots in very damp surroundings, invariably gave negative results and the epidermis of the plants remained intact. The experiments, however, always succeeded well if the fungus spores were sown on even a slight wound, or if injections were made with an ordinary Pravaz syringe, using distilled water with these fungus spores in suspension. In this way, the writer obtained the formation of macroconidia and microconidia even in cotyledons, and he thinks it not improbable that the cotyledons which have fallen on the ground, serve as a temporary substratum for the fungus, and thus help to spread the disease.

As a prophylactic measure, seeing that according to the observations made, damp is the factor which most promotes the development of the disease, it is advisable not to sow the seeds too thickly, so that the plants can be well aerated, and that the sun's rays can penetrate between the stems.

If the disease is very severe, it is best to pull up and destroy the infected plants, and not to use the healthy ones for green manure. In order to eradicate the disease, it would be necessary, for some years, to substitute another crop, such as cereals, for *Lupinus*, or any other herbageous plant likely to be attacked.

- 294 - *Solanum nigrum* and *S. Dulcamara*, Host Plants of *Synchytrium endobioticum* (*Chrysophlyctis endobiotica*), in Great Britain (1). — COTTON, A. D., in *Royal Botanic Gardens, Kew. Bulletin of Miscellaneous Information*, No. 10, pp. 272-275, London, 1916.

Wart Disease, or Black Scab, caused by the fungus *Synchytrium endobioticum* Perc. has caused very serious loss to the potato crops in many of the northern counties of England, and in part of Scotland.

Although certain varieties of potato have been proved to be not merely highly resistant, but for the present, at any rate, immune to Wart Disease, it is important to combat the fungus causing it. This can only be done by a complete and accurate knowledge of the life history of the parasite.

Many cases are known where Wart Disease has reappeared when healthy potatoes have been planted on infected land after an interval of 2 or 3 years, and several well authenticated records exist of disease appearing after a 6, or 7, years' interval.

Several explanations of such a recurrence of disease have been suggested. One hypothesis is, that the fungus may, in the absence of potatoes, have attacked other plants and managed to maintain an existence in their tissues.

As the casual examination of the roots of all kinds of weeds which occur in diseased potato field had given a negative result, a series of pot experiments were carried out in the spring of 1916 at the Pathological laboratory at Kew in order to throw light upon the problem. It was decided to test in the first place *Solanum dulcamara* and *S. nigrum* as being the most likely *Solanaceae* to be susceptible to disease, for they occur frequently in potato fields. The latter plant is also very common in certain Wart Disease areas.

The examination of the plants raised from seed sown in pots of infected soil from Ormskirk (Lancashire), showed conclusively that Wart Disease is capable of attacking and infecting, though to a moderate extent, both *Solanum nigrum* and *S. dulcamara*. It is therefore quite possible that when attempts are being made to eradicate the disease by discontinuance of potato-growing, or by the cultivation only of immune varieties, these two plants may act as host for *Synchytrium endobioticum* and may almost be said to act as "carriers".

Of great interest is the question of the original infection of the potato plant and the possibility of *Synchytrium* having spread from wild *Solanums* to the potato. Wart Disease was first described from Hungary and it is by no means inconceivable that a minute and hitherto unknown fungus such as *Synchytrium endobioticum* should have passed from wild plants to the cultivated, either in that country, or in any other where it was endemic.

(1) See also *B.* July 1913, pp. 1035-1036; *B.* January 1914, No. 76; *B.* February 1914, No. 182; *B.* October 1914, No. 956; *B.* December 1914, pp. 1788, 1792; *B.* August 1916, No. 938. (Ed.)

## WEEDS AND PARASITIC FLOWERING PLANTS.

- 295 - *Gomphocarpus fruticosus* and *G. physocarpus*, **Naturalised Weeds in Queensland (Australia).** — BAILEY, J. F. and WHITE, C. T., in *Queensland Agricultural Journal*, Vol. VI, Part 2, pp. 104-106, 10 Plates, Brisbane, August 1916.

A description of two weeds *Gomphocarpus fruticosus* R. Br. and *G. physocarpus* E. Mey belonging to the order *Asclepiadeae*, and generally known as "Wild cotton".

*G. fruticosus*, which is a native of Africa, is also found in the Mascarene Islands, Madeira, Canaries, Arabia and Southern Europe, perhaps naturalised in some of these latter places. It has long been a naturalised weed in New South Wales, where it is usually known as "Cape Cotton". In Queensland, it was first recorded as naturalised in 1892, and since that time has spread so rapidly, that it has become one of the worst weeds there.

*G. physocarpus* is a native of South and Tropical Africa and of the Cape Verde Islands. It is here recorded for the first time as naturalised in Queensland, but is apparently not so common as *G. fruticosus*.

These plants have several times been suspected of causing losses amongst stock and as they belong to the *Asclepiadae*, this most likely has some foundation, but though very common weeds, they seem to be seldom eaten by animals.

The down, or silk cotton, surrounding the seeds is of no use for textile purposes, and could only be used in the same way as kapok, but it would not pay to collect it for this purpose. The best method of eradicating these weeds is to hoe, or pull them up if they are young; or, if the plants are large and fruiting, to cut them below the surface of the ground and burn them when dry.

## INJURIOUS INSECTS AND OTHER ANIMALS.

INSECTS, ETC.,  
INJURIOUS TO  
VARIOUS  
CROPS.

- 296 - *Microgaster glomeratus*, a **Braconid Observed on Wheat, in Austria.** — KUTIN, ADOLF., in *Zeitschrift für Pflanzenkrankheiten*, Vol. 26, Part 8. pp. 452-454. Stuttgart, January 15, 1917.

At the beginning of May 1916, the Phytopathological Station of the Academy of Agriculture of Tabor (Bohemia) received from one of the communes in the neighbourhood of Prague some ears of wheat to which were attached numerous cocoons of a small Braconid, later identified as *Microgaster glomeratus*. As is well known, the adult insect lays its eggs in the larvae of *Pieris brassicae* ("large Garden white"), and is therefore very useful. The caterpillars which are attacked crawl, before dying, on to walls, hedges, etc., where they subsequently perish in the midst of



numerous braconid cocoons. In the case in question, they retired to die on wheat plants, which was a circumstance not hitherto observed in Austria. According to the farmers, this phenomenon is very common and has been noticed even in different, separate plots.

The cocoons were not all attached to the ear in the same manner. Indeed, the writer found that often the threads of the cocoons surrounded the whole ear, while in other cases, the cocoon was only attached to one side. The portion of the ear to which the cocoons were affixed also varies greatly; cocoons can be seen on the apex, middle, or base of the ear. As a rule, only one group of cocoons was found on each wheat ear, but it was not an uncommon occurrence to see two.

The presence of the cocoons is very injurious in so far that it prevents air and light having access to the interior of the wheat ear. This results in the abnormal development, or the absence, of the seeds. The writer has observed that the parts of the wheat ear to which the cocoons were attached bore no seeds.

297 - *Cassida pallidula* ("Egg plant Tortoise Beetle"), Parasitic on the Egg-plant and the Potato in Louisiana (United States). — JONES, T. H., in *United States Department of Agriculture, Bulletin* No. 442, pp. 1-8, fig. 1-3, Washington D. C., October 2, 1916.

During the spring of 1915, the larva of *Cassida pallidula* Boh. was observed in large numbers on the foliage of young egg plants and on the leaves of Irish potato at Baton Rouge, La.

This beetle, which was already known in the United States as a parasite of the above *Solanaceae*, and also of *Solanum elaeagnifolium*, *S. Carolinense*, *S. Xanti*, etc., has been hitherto reported as occurring in: California, Arizona, New Mexico, Texas, Louisiana — at New Orleans in 1912, it was observed on potato and egg plant and at Baton Rouge on *S. Carolinense* — Mississippi, Oklahoma, Kansas, Missouri, Indiana, Washington D. C. and Maryland.

The various stages of the insect are described from life-history studies carried on at Baton Rouge in 1915.

Three females of *C. Pallidula* reared in the insectary deposited respectively, 268, 269 and 231 eggs; the maximum number of eggs laid in one day was 12, and the minimum was 5.

The minimum life cycle in the insectary was found to be 27 days. With a continuous food supply available during the spring, summer and autumn, it is apparent that several generations, perhaps 5, will develop during this time at Baton Rouge.

Only one insect enemy of *C. pallidula* has been noted, and this is an undetermined egg parasite observed for the first time at Baton Rouge in August 1915. It appears to destroy only a small percentage of the eggs.

An experiment of spraying the *Cassida* larvae with a 12 per cent solution of arsenate of lead and arsenite of zinc indicates that the beetle can be satisfactorily controlled by the use of arsenical compounds.

- 298 - *Nezara viridula*, a Rhynchote Pest of the Tomato, the French Bean and the Potato in New South Wales (1). — FROGGATT, WALTER, W., in *The Agricultural Gazette of New South Wales*, Vol. XXVII, Part. 9, pp. 649-650. Pl. I. Sydney, 1916.

This cosmopolitan insect is quite a modern introduction into the vegetable gardens of New South Wales, and in the writer's opinion, this is the first record of its identification as an Australian agricultural pest.

*Nezara viridula* first appeared upon tomato plants in the neighbourhood of Sydney, about five years ago, since when it has increased in numbers, and for the last two years, it has been recorded as attacking the fruits and foliage of the tomato, the leaves and young pods of French beans and potato plants. How far it has extended its range outside the County of Cumberland it is hard to say, but as the species is known in Florida (U. S. A.) as an orange parasite, it may easily become established in the citrus orchards of New South Wales.

As the best means of hindering its diffusion, the writer suggests: the removal and destruction of the egg-infested leaves; the use of an oil-spray, or tobacco and soap wash in the early stages of the development of the insect; shaking the trees and gathering up and destroying the older individuals that fall to the ground.

- 299 - The Pear Leaf-Worm (*Gymnonychus californicus* Marlatt), A Hymenopteron Injurious to the Leaves of the Pear Tree in the United States. — NOUGARET, R. L., DAVIDSON, W. M. and NEWCOMER, E. J., in *United States Department of Agriculture, Bulletin* No. 438, pp. 1-24. Fig. 1-4; Pl. I-II. Washington, D. C. December 11, 1916.

*Gymnonychus californicus* Marlatt (the pear leaf-worm, or pear sawfly) so far as is known, is a native of the Pacific coast.

It was described from one female taken at Brockport, N. Y., and 10 females collected near Sacramento, (Cal.), by MATTHEW COOKE, in 1881. At that time it was reported also from Natoma and Santa Clara (Cal.). In the spring of 1909, it was quite common in the vicinity of Stanford University (Cal.) and in 1911, it was a pest in Tehama (Cal.), besides being generally distributed throughout the central counties, both on the coast and in the great interior valleys of Sacramento and San Joaquin (?). In 1913, the insect was reported as attacking pear foliage in Oregon. It

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(1) See also *B.* February 1913, No. 194 and *B.* May 1913, No. 609. (Ed.)

has not been observed in Arizona or Colorado. In the State of Washington, it was found in the Wenatchee Valley in 1914 and 1915. The identification of some larvae found destroying the leaves of pear in Geneva N. Y. in 1894 remains doubtful, but the collection of a specimen of *Gymn. californicus* at Brockport N. Y. indicates it may be found in the East of the United States.

The original hosts of the insect are probably one, or more, species of wild plants related to the pear (*Amelanchier*, *Crataegus*, *Sorbus*). As to cultivated plants, it is restricted to the different varieties of pear. Injury is confined to the foliage, and is done almost entirely by the larva, the presence of which is easily detected by the characteristic circular, or semi-circular, holes it eats in the leaves. Generally, it is of slight economic importance, but in cases of severe attack, trees have been defoliated and have suffered badly.

There is only one generation a year. The adults come out in March and April; the female sex greatly predominating. The eggs are inserted into the pear leaves, and the larvae feed on the foliage for an average period of 3 weeks. The larvae may be found on the leaves during April and May; in the State of Washington, the season is perhaps 10 days or a fortnight later than in California. Upon acquiring full growth, the larvae drop to the ground, and bury themselves at a slight depth. They weave round themselves a cocoon in which the insect remains a little over 10 months, at first as larva, and later, for a period of 2 or 3 weeks as a pupa. At the end of the pupal stage, the adult issues from the cocoon and comes forth from the ground.

The insect seems to have few natural enemies and these are very ineffectual in controlling it.

The following artificial remedies are suggested:

- a) Poison spray. — Four pounds lead arsenate to 100 gall. water;
- b) Contract spray. — Fish oil soap 4 lbs: water 100 gall.; nicotine sulphate (40 per cent concentrate) 1 to 1,200;
- c) The Government formula for the control of pear thrips, (*Taeniothrips pyri* Daniel (1).

In the case of ordinary infestation, the latter formula is most efficacious. When the attack is severe and threatens the defoliation of limbs, or whole trees; the first of the above remedies should be used. The best

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(1) This formula is as follows; 3 % petroleum emulsion (1 hl of hot water, 30 kg of fish oil soap; 20 kg of petroleum) to which is added 1 % or 1  $\frac{2}{3}$  % tobacco extract (containing 2.75 % of nicotine). Cfr. MERRILL, G. E., « How to Fight the Pear Thrips », *The Monthly Bulletin of the State Commission of Horticulture*, Vol. I, No. 2, pp. 54-56. Sacramento, California, 1912. (Ed.)



time for application is when the largest larvae are about half grown, and when the holes in the leaves are not larger than  $\frac{1}{2}$  inch in diameter. At this time nearly all the eggs have hatched.

300 - *Laspeyresia molesta*, an Important New Insect Enemy of the Peach and of Other Fruit Trees in the United States. — QUAINANCE, A. L. and WOOD, W. B. in *The Journal of Agricultural Research*, Vol. VII, No. 8, pp. 373-383, Plates 26-31. Washington. D. C., November 20, 1916.

This preliminary paper calls attention to the discovery of an insect, which is an enemy of the peach and, to a lesser extent, of other fruit trees. It is believed to be new to the United States, and has apparently been hitherto unknown to science.

The insect is a moth belonging to the tortricid genus *Laspeyresia* which contains numerous species of prime importance as pests in different parts of the world.

The present species, described by Mr. BUSCK under the name of *L. molesta*, is very similar to the European *Laspeyria fune! rana*, although it differs from the latter in certain respects.

There are several American species closely allied to *L. molesta* — one of these, *L. pyricolana* Murtfeldt, may easily be confused with it. It is, however unlikely that *L. molesta* is a native of America, most probably it has been accidentally introduced from Japan, where closely allied species also occur, though the present species has not yet been reported.

So far as is known to the writers, the new insect in the United States is still confined to the District of Columbia. It is very generally present on peach trees in the city of Washington and in adjacent towns in Virginia and Maryland. Examples of injury to the peach by what is believed to be this moth have, however, been seen in the environs of Baltimore. The insect is thought to have been present in the District of Columbia for 4 or 5 years, or perhaps somewhat longer. It was not till the summer of 1916 that it could be carefully studied.

The larvae have been found injuring twigs of the peach, plum, and cherry and the fruit of the peach; the latter tree seems to be its favourite host. Attack on the twigs begins in spring and continues till the autumn. The larvae make burrows in the twigs, but when the latter harden, they come out and feed, more or less, on the exterior, cutting holes and pits into the bark and causing a copious exudation of gum which renders the injury quite conspicuous.

The injuries to the twigs of bearing orchards, while important as interfering with normal growth, are not so serious as the damage caused in nurseries, where the destruction of the terminal growing shoots results in the formation of lateral shoots, and the production of a much-branched and bushy plant unsuitable for nursery stock.

The fruit may be attacked while quite green, the infestation increasing as it approaches maturity.

The larvae perforate the fruit at different places, or take advantage of pre-existing punctures and abrasions. They eat out pockets, or cavities, in the flesh; the inconspicuous entrance holes of the young larvae often render it difficult to detect wormy fruit by exterior examination.

The caterpillar, when full grown, seeks some protected place on different parts of the tree, or even on the ground where it hibernates in silken cocoons, pupation occurring in the spring. The adults appear also in the spring. It would appear that there are 2, and probably 3 broods of larvae each year.

301 - *Plectrodera scalator*, a Coleopteron Injuring *Populus deltoides* and *Salix alba*, in the United States. — MILLIKEN, F. B., in *United States Department of Agriculture, Bulletin No. 424* (Professional Paper), pp. 1-7, figs. 1-3, pl. I. Washington, D. C. November 9, 1916.

*Plectrodera scalator*, Fab. (cottonwood borer) is one of the largest beetles found in Kansas, where it injures shade trees, such as *Populus deltoides* and *Salix alba*.

A description is given of the various stages of the insect and also an account of its life-history and habits.

The females lay their eggs chiefly in cuttings and very young trees, in the stem, or trunk, at, or a little below, the surface of the ground. The young larvae cut the bark and prevent the sap flow, while the larger larvae tunnel the wood, thus weakening the trees against wind.

The eggs are deposited principally during July and August. The larvae work in the trees until the second summer after the eggs hatch; the adults emerge from about the middle of June until the 1<sup>st</sup> of August.

Oviposition in shade trees may be prevented by a screen cone of galvanised netting. The young larvae can be removed before they injure the tree severely, if the remedial work is done during the first two weeks of September.

Removal of the large larvae from deep tunnels often injures the tree more than would the larvae if they were allowed to remain and complete their development.

## INJURIOUS VERTEBRATES.

302 - Experiments Made in Austria in Protecting Forest Trees (Especially Resinous Kinds) from Injury by Game. — SEDLACZEK WALTHER, in *Centralblatt für das gesamte Forstwesen*, Year 42, Parts 3/4, pp. 115-134. Vienna, 1916.

For many years, the writer has made use of the most varied means of protecting forest trees in different parts of Austria. A screen round

the threatened trees has, in every case, proved the most efficacious method. Inferior results have been obtained by affixing to the trunks bands coated with a composition of a tar basis (TITLBACH'S system), or by using wire-netting. Less certain methods, which are, however, worthy of trial, consist in surrounding the trunk with branches, or removing with a knife, a small portion of the cortex; in the latter case, the exuding resin on hardening, protects the tree from the teeth of the game. These 3 methods chiefly prevent the bark being stripped off. The best protection against rodents is tow; this should not be simply placed round the trunk, but ought to be glued to it. As a rule, the expense is not very great, but in some districts tow is dear, and in this case, it should only be used for valuable trees. Painting the trunk with "Pinostris" is also advisable and costs less. With the idea that game could be scared away by unpleasant smells, noise, and light, KERN made a little tin stove perforated with many holes and filled with sawdust impregnated with substances producing an acrid smoke while burning. In this, be placed percussion caps to make detonations and flashes of light. The acrid smoke is perceptible at 150-300 paces in the direction of the wind, while from time to time, the caps explode in the stove with a loud report and a bright flash. This apparatus is called the "smoking fox", (rauchender Fuchs) and has been used with success when it was a question of protecting the trees for a short period of time.



INSTITUT INTERNATIONAL D'AGRICULTURE  
BUREAU DES RENSEIGNEMENTS AGRICOLES ET DES MALADIES DES PLANTES

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# BULLETIN MENSUEL

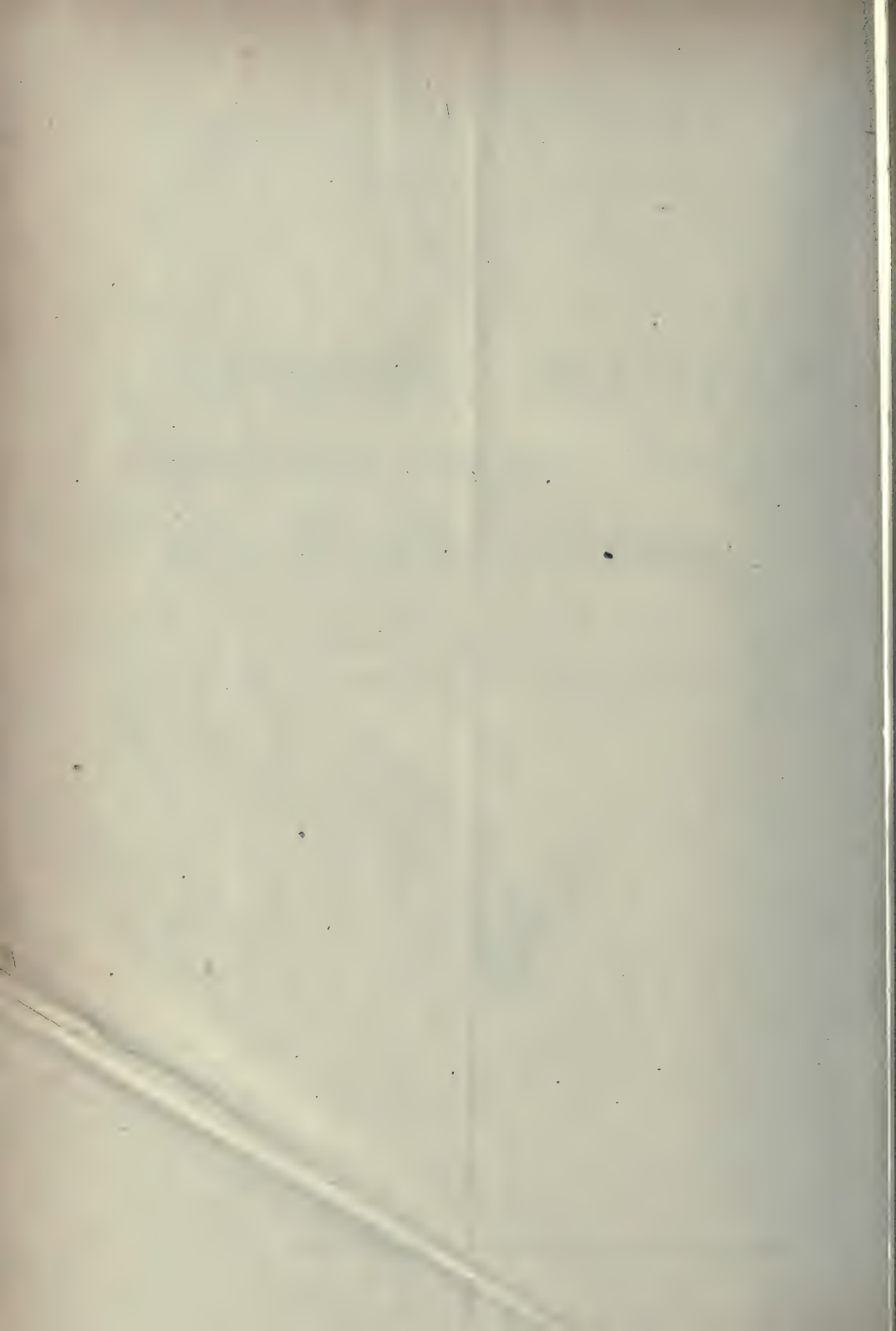
## DES RENSEIGNEMENTS AGRICOLES

## ET DES MALADIES DES PLANTES

ANNÉE VIII - NUMÉRO 4

AVRIL 1917





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Le Bureau n'assume aucune responsabilité quant aux opinions et aux résultats d'expériences résumés dans le Bulletin.

Les remarques de la Rédaction se reconnaissent à l'abréviation : (N. d. R.).



## PREMIÈRE PARTIE

# LE MOUVEMENT INTERNATIONAL DES ALIMENTS CONCENTRÉS POUR LE BÉTAIL.

Numéro 3.

1<sup>er</sup> Avril 1917.

SOMMAIRE. — Introduction (p. 503). — Production mondiale des aliments concentrés pour le bétail (p. 505). — Commerce international des aliments concentrés pour le bétail (p. 525). — Prix des aliments concentrés pour le bétail (p. 534). — Bibliographie (p. 541).

## INTRODUCTION.

Cette troisième Revue donne le *Mouvement international des aliments concentrés* jusqu'à fin 1916, dans la mesure où les circonstances présentes permettent de le faire et conformément au plan établi dans la Revue n° 2 (1).

Il y a été, en outre, introduit deux nouveaux groupes : le soja et le tourteau de soja, les résidus de la brasserie ; dont on a donné, au chapitre des coefficients, les facteurs sur la base desquels ont été calculés les rendements en partant des quantités de matières premières disponibles.

Bien que les événements internationaux aient ralenti le mouvement, comme cela ressort d'ailleurs des chiffres reportés à cet égard, il n'est toutefois pas douteux que la tendance qui s'est affirmée dans l'importation du soja dans les pays consommateurs d'aliments concentrés doit reprendre son cours ascendant, aussi était-il bon de fixer dès maintenant l'extension prise par ce mouvement. Les résidus de la brasserie ont acquis encore plus d'importance comme aliments concentrés du bétail (y compris la levure et

(1) *Bulletin des Renseignements agricoles et des Maladies des plantes*, VII, 4, 499-542, 1916.

les lies desséchées), tels quels ou après avoir été préparés, et il est certain que la marge de cette utilisation n'a pas été atteinte dans nombre de pays.

En ce qui concerne le colza, nous ne donnons que la production de l'Inde, dont, en ce moment, les chiffres courants ont seuls de l'importance.

Dans un nouveau tableau des prix des divers aliments concentrés nous avons donné les cours de quelques produits (brisures de riz, caroubes, drèches de brasserie), auxquels les conditions du moment prêtent plus d'actualité.

Ainsi, dans le tableau des prix des tourteaux divers, avec les cours des tourteaux de sésame et de palmiste, nous avons introduit ceux des tourteaux de soja, de colza et de tournesol sur leurs marchés les plus importants.

Quelques observations générales s'imposent à propos de chaque chapitre.

*Production.* — Les nouvelles dispositions qui exigent que l'on tire du froment un plus fort rendement en produits panifiables, ont fait, dans un certain nombre de pays, baisser la production de son. Dans le mouvement des graines et fruits oléagineux, on observe de même un ralentissement général, qui a eu pour conséquence une production de tourteaux moindre, surtout dans les pays importateurs. En ce qui concerne les amandes de palme, il s'est produit une dislocation du mouvement qui a concentré la production de tourteaux de palmiste dans le Royaume-Uni. On constate aussi un rendement en résidus de betterave sucrière plus bas, dans les pays pour lesquels on a des données, par le fait que la matière première traitée a diminué; il faut en excepter les États-Unis, par suite de la forte impulsion qu'on y a donné à la production du sucre de betterave.

*Commerce.* — Il en est du commerce comme de la production. On y remarque presque un arrêt général dans le trafic d'aliments concentrés; cela est dû aux difficultés de transport et, en partie, à la production insuffisante des fourrages chez les pays exportateurs, spécialement dans l'Amérique méridionale.

*Prix.* — Enfin l'insuffisance des disponibilités sur les marchés consommateurs a eu pour conséquence une notable augmentation des prix, à laquelle concourent aussi d'autres causes.

*Bibliographie.* — La bibliographie tirée des publications parvenues et dépouillées à l'Institut international d'agriculture pendant la période écoulée depuis la publication de la précédente Revue, a atteint 680 titres, concernant, pour la plupart, les études faites pour la recherche de nouveaux aliments afin de suppléer à l'insuffisance des fourrages ordinaires.

# PRODUCTION DES ALIMENTS CONCENTRÉS POUR LE BÉTAIL

## Coefficients.

D'après la méthode établie dans la Revue précédente, la production des aliments concentrés pour le bétail considérés a été évaluée sur la base des disponibilités pour la consommation des matières premières et à l'aide des coefficients suivants tirés de la pratique industrielle.

$$\text{SON DE BLÉ} = [(a + c) - (b + d)] \times \frac{25}{100}$$

Production = *a*. Quantité ensencée = *b*. Importation = *c*. Exportation = *d*.

$$\text{SON DE SEIGLE} = [(a + c) - (b + d)] \times \frac{32}{100}$$

Production = *a*. Quantité ensencée = *b*. Importation = *c*. Exportation = *d*.

### RÉSIDUS DE RIZ.

*Pays producteurs :*

$$\text{Balle} = [(a + c + e) - (b + d)] \times \frac{20}{100}; \text{Brisures} = [(a + c + e) - (b + d)] \times \frac{10}{100}$$

Production = *a*. Quantité ensencée = *b*. Importation riz non décortiqué = *c*. Exportation du riz non décortiqué = *d*. Equivalent de l'exportation du riz décortiqué = *e*.

*Pays non producteurs :*

$$\text{Balle} = (a - b) \times \frac{20}{100}; \text{Brisures} = (a - b) \times \frac{10}{100}$$

Importation riz non décortiqué = *a*. Exportation riz non décortiqué = *b*.

$$\text{TOURTEAUX DE LIN} = [(a + c) - (b + d)] \times \frac{50}{100}$$

Production = *a*. Quantité ensencée = *b*. Importation = *c*. Exportation = *d*.

TOURTEAUX DE GRAINES DE COTON. — Sauf pour les États-Unis, pour qui le coefficient adopté par le Bureau fédéral du Recensement est de 43,8 % de la graine obtenue, on a employé pour les disponibilités des autres pays un coefficient pour l'évaluation de la production de tourteaux égal à 50 %, en raison des conditions différentes de l'extraction.

$$\text{TOURTEAUX DE COLZA} = [(a + c) - (b + d)] \times \frac{50}{100}$$

Production = *a*. Quantité ensencée = *b*. Importation = *c*. Exportation = *d*.

TOURTEAUX DE SOJA. — Pour les pays importateurs de soja la production de tourteaux a été évaluée au taux de 80 % de l'importation nette.

AUTRES TOURTEAUX OLÉAGINEUX. — La production a été évaluée au taux de 50 % des disponibilités en matières premières.

### RÉSIDUS DE LA PRODUCTION DU SUCRE DE BETTERAVE.

$$\text{Cossettes (matière sèche)} = \text{Production betterave} \times \frac{5}{100}; \text{Mêlées} = id. \times \frac{2}{100}$$

### RÉSIDUS DE LA BRASSERIE.

$$\text{Tourillons} = \text{Production bière} \times \frac{1}{100}; \text{Drèches desséchées} = id. \times \frac{6}{100}; \text{Résidus di-}$$

$$\text{vers} = id. \times \frac{1}{100}$$



## Résidus de la meunerie.

## PRODUCTION DE SON DE BLÉ

(évaluée d'après les disponibilités de blé pour la consommation).

Pays.	1912.	1913.	1914.	1915.	1916.
	1000 kg.	1000 kg.	1000 kg.	1000 kg.	1000 kg.
Allemagne.....	1 501 325	1 583 400	.....	.....	.....
Argentine.....	348 525	447 000	341 444	357 020	437 475
Autriche-Hongrie.....	1 544 875	1 358 125	.....	.....	.....
Belgique.....	469 725	479 625	.....	.....	.....
Bulgarie.....	181 500	215 525	144 770	.....	.....
Chili.....	119 276	128 328	83 195	144 850	.....
Danemark.....	68 950	76 425	53 979	68 197	.....
Egypte.....	184 500	237 575	208 406	236 322	228 621
Espagne.....	625 600	676 000	777 567	918 672	.....
Etats-Unis.....	4 094 000	4 019 600	4 241 175	4 872 539	2 723 090
France.....	2 206 825	2 318 225	2 140 914	1 749 048	1 494 048
Algérie.....	114 918	186 368	.....	177 291	139 550
Tunisie.....	13 604	37 911	14 250	59 475	28 225
Royaume-Uni.....	1 752 400	1 701 975	1 720 048	1 600 697	1 658 550
Australie.....	219 551	275 550	230 623	94 770	769 698
Canada.....	577 775	582 525	506 703	1 693 585	42 615
Inde britannique.....	1 699 561	1 795 419	1 602 236	1 990 215	1 635 838
Nouvelle-Zélande.....	47 810	32 226	34 275	45 960	44 253
Italie.....	1 426 625	1 764 775	1 264 646	1 257 252	910 077
Japon.....	182 550	206 700	162 449	165 875	.....
Norvège.....	6 000	7 475	14 249	19 099	.....
Pays-Bas.....	132 950	139 650	130 174	186 231	213 918
Roumanie.....	197 700	200 875	120 248	547 523	.....
Russie d'Europe et d'Asie.....	3 842 925	5 259 500	3 773 342	5 431 161	.....
Suède.....	89 800	107 475	.....	118 540	.....
Suisse.....	138 300	154 225	131 271	146 145	120 725

Pour ce qui concerne l'évaluation du son de blé et de seigle en Allemagne, voir les remarques de la Revue N° 2.

Par suite des nouvelles dispositions adoptées dans plusieurs pays en vue d'augmenter le rendement en produits panifiables, lesquelles entraînent une diminution de rendement en son, on a conservé pour l'année 1915, en ce qui concerne l'Italie, un coefficient moyen de 20 % de rendement en son de blé, qu'on a ensuite réduit à 15 % pour l'année 1916. Pour la France, on a calculé pour 1916 un rendement moyen en son de blé de 20%. Il est à prévoir qu'en 1917 ce rendement sera encore abaissé, même dans d'autres pays restés jusqu'ici dans la limite normale de 25 % adoptée : ainsi, dans le Royaume-Uni, les nouvelles dispositions de 1917 ont élevé pratiquement le rendement en farine à 80 (81) %, et facultativement à 85 (86) % (*The Manufacture of Flour and Bread Order*, N° 62, 1917).

# PRODUCTION DE SON DE SEIGLE

(évaluée d'après les disponibilités de seigle pour la consommation).

Pays.	1912.	1913.	1914.	1915.	1916.
	1000 kg.	1000 kg.	1000 kg.	1000 kg.	1000 kg.
Allemagne.....	2 894 717	3 045 716			
Autriche-Hongrie .....	1 262 272	1 136 000			
Belgique .....	195 008	216 960			
Bulgarie.....	38 446	47 724			
Chili.....	1 056	1 088			
Danemark.....	179 712	197 012	120 074	119 886	
Espagne .....	122 432	197 504	158 001	176 799	
Etats-Unis .....	256 128	290 400	234 577	271 603	201 780
France .....	368 032	373 472	312 775	224 739	247 492
Australie.....	416	704			
Canada.....	18 779	16 992	13 395	13 415	12 799
Italie.....	39 771	43 260	38 171	29 776	37 880
Norvège.....	61 820	68 189	54 280	60 552	
Pays-Bas.....	198 400	208 096	150 640	118 520	96 300
Roumanie.....	4 672	60 896	1 821	16 947	
Russie d'Europe et d'Asie.....	7 072 480	6 789 600	5 394 507	6 556 313	
Suède.....	198 674	187 008	241 713	183 680	177 373
Suisse.....	18 652	18 430	15 001	15 570	

## PRODUCTION DE RÉSIDUS DE RIZ

(évaluée d'après les disponibilités de riz pour la consommation).

Pays.	1912.		1913.		1914.		1915.		1916.	
	Balle.	Brisures.	Balle.	Brisures.	Balle.	Brisures.	Balle.	Brisures.	Balle.	Brisures.
	1000 kg.	1000 kg.	1000 kg.	1000 kg.	1000 kg.	1000 kg.	1000 kg.	1000 kg.	1000 kg.	1000 kg.
Espagne.....	48 300	24 150	44 000	22 000	48 980	24 490	46 680	23 340	.....	.....
États-Unis.....	100 980	50 490	103 200	51 630	96 320	48 160	120 120	60 060	172 100	86 050
Inde britannique.....	9 068 338	.....	9 083 492	.....	8 669 119	.....	6 388 166	.....	5 093 541	.....
Italie.....	95 674	47 837	113 340	56 670	118 380	59 190	110 363	55 182	110 011	55 005
Japon.....	1 752 094	.....	2 140 634	.....	1 995 807	.....	1 525 113	.....	.....	.....
Indes or. néerlandaises..	1 084 461	.....	1 025 346	.....	1 285 413	642 707	.....	.....	.....	.....
Siam*.....	100 155	50 078	188 717	94 359	.....	.....	.....	.....	.....	.....

a) Pays producteurs.

\* d'après l'exportation en riz décortiqué.

b) Pays non producteurs.

Pays.	1912.		1913.		1914.		1915.		1916.	
	Balle.	Brisures.	Balle.	Brisures.	Balle.	Brisures.	Balle.	Brisures.	Balle.	Brisures.
	1000 kg.	1000 kg.	1000 kg.	1000 kg.	1000 kg.	1000 kg.	1000 kg.	1000 kg.	1000 kg.	1000 kg.
Allemagne.....	20 074	10 037	32 678	16 339	.....	.....	.....	.....	.....	.....
Argentine.....	2 960	1 480	3 520	1 760	2 320	1 160	.....	.....	.....	.....
Autriche-Hongrie.....	16 200	8 100	17 018	8 509	.....	.....	.....	.....	.....	.....
Belgique.....	9 840	4 920	4 400	2 200	.....	.....	.....	.....	.....	.....
Danemark.....	0,2	0,1	.....	0,6	.....	0,3	.....	.....	.....	.....
France.....	11 656	5 828	9 456	4 728	7 880	3 940	12 100	6 050	.....	.....
Algérie.....	200	100	200	100	260	130	1 400	700	880	440
Royaume-Uni.....	19 360	9 680	17 720	8 860	.....	.....	.....	.....	.....	.....
Australie.....	5 280	2 640	5 060	2 530	.....	.....	.....	.....	.....	.....
Canada.....	3 580	1 790	4 420	2 210	4 620	2 310	5 280	2 640	6 400	3 200
Norvège.....	20	10	.....	.....	.....	.....	.....	.....	.....	.....
Russie.....	8 220	4 110	6 280	3 140	.....	.....	.....	.....	.....	.....
Suède.....	2 980	1 490	2 040	1 020	2 160	1 080	.....	.....	.....	.....
Suisse.....	1 800	900	2 760	1 380	1 920	960	680	340	.....	.....



## Résidus de l'huilerie.

Lin.

## PRODUCTION DE TOURTEAUX DE LIN

(évaluée d'après les disponibilités de graines pour la consommation).

Pays.	1912.	1913.	1914.	1915.	1916.
	1000 kg.	1000 kg.	1000 kg.	1000 kg.	1000 kg.
a) Pays producteurs.					
Autriche-Hongrie.....	27 594	36 670	.....	.....	.....
Belgique.....	41 725	56 765	.....	.....	.....
Bulgarie.....	77	.....	.....	.....	.....
Chili.....	340	143	.....	.....	.....
Etats-Unis.....	369 267	237 164	257 537	322 702	313 965
France.....	73 609	119 852	63 154	17 342	.....
Canada.....	166 633	.....	42 747	85 869	10 791
Inde britannique.....	.....	.....	93 526	9 983	57 374
Italie.....	24 410	27 170	18 944	21 974	16 648
Pays-Bas.....	78 495	102 851	97 821	36 490	88 752
Roumanie.....	5 518	.....	473	.....	.....
Russie d'Europe.....	94 262	145 566	.....	.....	.....
Suède.....	.....	14 145	.....	.....	.....
b) Pays importateurs.					
Allemagne.....	162 350	278 100	.....	.....	.....
Danemark.....	5 800	9 900	.....	.....	.....
Royaume-Uni.....	134 600	308 900	62 277	54 013	63 682
Australie.....	1 400	1 748	.....	.....	.....
Norvège.....	5 000	7 350	.....	.....	.....

## Graines de coton.

PRODUCTION DE TOURTEAUX ET FARINE DE GRAINES DE COTON  
AUX ETATS-UNIS (d'après la graine travaillée).

Production.	1912.	1913.	1914.	1915.	1916.
	1000 kg.	1000 kg.	1000 kg.	1000 kg.	1000 kg.
Production de graines de coton..	5 537 457	5 719 801	(6 803 887)	.....	.....
Graines de coton travaillées:					
Alabama.....	314 996	388 681	455 746	297 656	Chiffres non disponibles.
Arkansas.....	226 216	276 730	285 136	243 749	
Caroline du Nord.....	281 046	288 444	351 775	270 008	
Caroline du Sud.....	306 281	226 543	417 992	297 250	
Floride.....	17 299	21 455	30 078	.....	
Géorgie.....	572 285	781 247	956 107	717 508	
Louisiane.....	137 658	139 276	159 596	125 429	
Mississippi.....	357 100	455 703	478 907	341 134	
Missouri.....	20 338	25 396	29 235	22,262	
Oklahoma.....	308 946	373 118	372 611	208 128	
Tennessee..	149 416	235 465	252 134	205 423	
Texas.....	1 425 157	1 058 112	1 373 936	1 018 501	
Autres Etats.....	37 723	55 109	79 974	64 088	
	4 154 461	4 325 279	5 243 227	<sup>1)</sup> 3 811 136	
Production de tourteaux et farine	1 813 463	1 896 017	2 296 533	(1 669 278)	

(1) Y compris 30 102 tonnes métriques qu'on estime à travailler.

## EXPORTATIONS DE GRAINES DE COTON PAR PAYS PRODUCTEURS.

Pays.	1912.	1913.	1914.	1915.	1916.
	1000 kg.	1000 kg.	1000 kg.	1000 kg.	1000 kg.
Brésil.....	36 793	49 779	31 060	10 017	(1)
Chine.....	18 598	11 032	7 689	7 830	(1)
Egypte.....	472 302	373 703	346 060	367 499	218 665
Etats-Unis.....	19 090	11 161	4 974	936	(2) 571
Colonies francaises:					
Nouvelle-Calédonie.....	.....	39	737	1 331	(1)
Territoires britanniques:					
Inde.....	144 230	218 307	329 526	67 062	(3) 82 695
Nigérie.....	4 123	5 981	5 444	(1)	(1)
Ouganda (an. finiss. le 31 mars.)	2 974	5 704	9 000	(1)	(1)
	151 327	229 992	343 970	(67 062)	(82 695)
Pérou.....	14 583	26 422	18 228	(1)	(1)
	712 693	697 128	752 718	(454 675)	(301 931)

(1) Chiffres non disponibles. — (2) 10 mois. — (3) 11 mois.

## MOUVEMENT DE GRAINES DE COTON PAR PAYS IMPORTATEURS.

Pays.	1912.	1913.	1914.	1915.	1916.
	1000 kg.	1000 kg.	1000 kg.	1000 kg.	1000 kg.
Allemagne :					
importation.....	214 097	219 797	(1) 120 973	(2)	(2)
exportation.....	1 802	809	(1) 230	(2)	(2)
	212 295	218 988	(1) 120 743	(2)	(2)
Autriche-Hongrie :					
importation.....	11 233	3 813	(1) 2 096	(2)	(2)
exportation.....	1 498	1 255	.....	(2)	(2)
	9 735	2 558	(1) 2 096	(2)	(2)
France :					
importation.....	34 935	17 670	14 742	2 303	(3) 1 624
exportation.....	141	925	708	1 955	(3) 630
	34 794	16 745	14 034	348	(3) 994
Royaume-Uni :					
importation.....	640 228	625 205	649 835	502 522	334 520
Japon :					
importation.....	.....	12 039	14 373	31 187	(4) 10 131

(1) 1<sup>er</sup> semestre. — (2) Chiffres non disponibles. — (3) 11 mois. — (4) 10 mois.

## PRODUCTION DE TOURTEAUX DE GRAINES DE COTON

## DANS LES PAYS IMPORTATEURS

(évaluée d'après les disponibilités de graines).

Pays.	1912.	1913.	1914.	1915.	1916.
	1000 kg.	1000 kg.	1000 kg.	1000 kg.	1000 kg.
Allemagne.....	106 147	109 494	(1) 60 371	(2)	(2)
Autriche-Hongrie.....	4 867	1 279	(1) 1 048	(2)	(2)
France.....	17 397	8 372	7 017	174	(3) 497
Royaume-Uni.....	320 116	312 602	324 917	251 261	167 101
Japon.....	.....	6 019	7 186	15 593	(4) 5 065

(1) 1<sup>er</sup> semestre. — (2) Chiffres non disponibles. — (3) 11 mois. — (4) 10 mois.

## Colza.

Au tableau de la production de tourteaux de colza et de navette donné dans la Revue N° 2 il suffit d'ajouter les chiffres concernant l'Inde britannique pour la dernière période triennale 1916-1918, chiffres basés sur les disponibilités de colza à l'intérieur :

	1914	1915	1916
	1000 kg.	1000 kg.	1000 kg.
Production de tourteaux de colza dans l'Inde britannique. . . .	426 879	571 634	480 205



**Arachides.**  
**EXPORTATIONS D'ARACHIDES PAR PAYS PRODUCTEURS.**

Pays.	1912.	1913.	1914.	1915.	1916.
	1000 kg.	1000 kg.	1000 kg.	1000 kg.	1000 kg.
Colonies allemandes :					
Est-africain allemand.....	6 079	(1)	(1)	(1)	(1)
Chine :					
<i>en cosses</i> .....	51 793	63 741	35 773	20 082	(1)
équivalent en décortiquées..	38 845	47 806	26 830	15 061	(1)
décortiquées.....		5 263	35 204	13 063	(1)
	38 845	53 069	62 034	28 124	(1)
Egypte*.....	794	557	296	163	983
Colonies françaises :					
Sénégal :					
<i>en cosses</i> .....	184 762	229 941	280 527	303 067	(1)
équivalent en décortiquées..	130 571	172 456	210 395	227 300	(1)
Haut-Sénégal et Niger :					
<i>en cosses</i> .....	1 761	8 577	2 435	(1)	(1)
équivalent en décortiquées..	1 321	6 433	1 821	(1)	(1)
décortiquées.....	5 830	(1)	(1)	(1)	(1)
Guinée française :					
<i>en cosses</i> .....	2 020	3 541	3 325	1 266	(1)
équivalent en décortiquées..	1 515	2 656	2 494	949	(1)
Mayotte et dép. :					
<i>en cosses</i> .....	34	(1)	(1)	(1)	(1)
équivalent en décortiquées..	25	(1)	(1)	(1)	(1)
Indochine :					
décortiquées.....	405	643	(1)	(1)	(1)
Etabliss. français de l'Inde :					
<i>en cosses</i> .....	5 281	3 511	(1)	(1)	(1)
équivalent en décortiquées..	3 961	2 633	(1)	(1)	(1)
décortiquées.....	85 726	103 727	(1)	(1)	(1)
	229 354	(288 548)	(214 710)	(228 249)	(1)
Territoires britanniques :					
Inde.....	221 679	259 158	266 050	131 676	(2) 158 601
Gambie.....	65 199	68 486	67 958	97 680	(1)
Nigérie :					
<i>en cosses</i> .....	1 743			(1)	(1)
équivalent en décortiquées..	1 307	19 000	15 000	(1)	(1)
décortiquées.....	2 559			(1)	(1)
Ouganda.....	464	598	390	8	(1)
	291 208	347 242	349 398	(229 364)	(158 601)
Japon.....	3 919	5 928	5 556	5 580	(3) 6 547
Colonies néerlandaises :					
Indes orientales :					
<i>en cosses</i> .....	3 266	13 793	9 974		(1)
équivalent en décortiquées..	2 449	10 345	7 480	11 235 **	(1)
décortiquées.....	9 940	6 268	7 655		(1)
Colonies portugaises :					
Est-africain portugais.....	12 389	16 613	15 135	(11 235)	(1)
	8 672	5 759	(4) 792	(1)	(1)
	501 352	(692 632)	(647 921)	(502 715)	(166 131)

\* Exportées pour la consommation directe. — \*\* Java seulement. — (1) Chiffres non disponibles. — (2) 11 mois. — (3) 10 mois. — (4) Chiffre-partielle.

## MOUVEMENT D'ARACHIDES PAR PAYS IMPORTATEURS.

Pays.	1912.	1913.	1914.	1915.	1916.
	1000 kg.	1000 kg.	1000 kg.	1000 kg.	1000 kg.
Allemagne:					
importation.....	69 869	98 085	(1) 83 940	(2)	(2)
Danemark :					
importation .....	1 188	3 666	(1) 2 418	(2)	(2)
Etats-Unis :					
importation :					
en cosses.....	5 324	5 844	9 042	5 266 (3)	3 802
équivalent en décortiquées..	3 993	4 383	6 781	3 949 (3)	2 851
décortiquées.....	776	5 019	11 845	4 905 (3)	7 797
	4 769	9 402	18 626	8 854 (3)	10 558
France :					
importation :					
en cosses.....	222 380	255 713	270 194	255 713 (4)	135 367
équivalent en décortiquées..	166 785	191 785	202 645	191 785 (4)	101 525
décortiquées.....	245 236	237 754	269 814	237 754 (4)	217 585
	412 021	429 539	472 459	429 539 (4)	319 110
exportation :					
en cosses.....	13 644	16 999	12 634	8 015 (4)	2 858
équivalent en décortiquées..	10 233	12 749	9 475	6 011	2 143
décortiquées.....	5 665	2 192	1 909	3 615 (4)	1 331
	15 898	14 941	11 384	9 626 (4)	3 474
	396 123	414 598	461 075	419 913 (4)	315 636
Pays-Bas :					
importation.....	52 179	67 428	64 167	47 416 (4)	18 865
exportation.....	12 794	19 616	21 700	6 548	46
	39 385	47 812	42 467	40 868 (4)	18 819

(1) 1<sup>er</sup> semestre. — (2) Chiffres non disponibles. — (3) 10 mois. — (4) 11 mois.

PRODUCTION DE TOURTEAUX D'ARACHIDES DANS LE PAYS IMPORTATEURS  
(évaluée d'après les disponibilités d'arachides).

Pays.	1912.	1913.	1914.	1915.	1916.
	1000 kg.	1000 kg.	1000 kg.	1000 kg.	1000 kg.
Allemagne.....	34 934	49 042	(1) 41 970	(2)	(2)
Danemark.....	594	1 833	(1) 1 209	(2)	(2)
Etats-Unis.....	2 384	2 701	9 313	4 427 (3)	5 279
France.....	198 061	207 299	230 537	209 956 (4)	157 818
Pays-Bas.....	19 692	23 906	21 233	20 434 (4)	9 409

(1) 1<sup>er</sup> semestre. — (2) Chiffres non disponibles. — (3) 10 mois. — (4) 11 mois.

## Sésame.

## EXPORTATIONS DE SÉSAME PAR PAYS PRODUCTEURS.

Pays.	1912.	1913.	1914.	1915.	1916.
	1000 kg.	1000 kg.	1000 kg.	1000 kg.	1000 kg.
Colonies allemandes:					
Est-africain allemand.....	1 881	(1)	(1)	(1)	(1)
Chine .....	120 892	123 001	75 638	138 934	(1)
Empire ottoman *.....	12 192	(1)	(1)	(1)	(1)
Colonies françaises:					
Haut Sénégal et Niger.....	7	50	(1)	(1)	(1)
Guinée française.....	411	762	889	507	(1)
Indochine.....	894	1 246	(1)	(1)	(1)
	1 312	(2 058)	(889)	(507)	(1)
Territoires britanniques:					
Inde.....	62 360	104 069	100 940	11 293 (2)	61 344
Soudan .....	6 094	6 839	(1)	(1)	(1)
Est-africain britan. (année finis- sant le 31 mars) .....	3 494	4 088	3 871	(1)	(1)
Ouganda (an. fin. le 31 mars) ..	709	1 596	910	(1)	(1)
Nigérie.....	448	1 055	(1)	(1)	(1)
Sierra-Leone.....	46	36	(1)	(1)	(1)
	73 151	117 683	(105 721)	(11 293)	(61 344)
Colonies néerlandaises:					
Indes orientales néerl.....	1 302	1 987	2 445	(1)	(1)
Colonies portugaises:					
Est-africain portugais.....	1 330	7 963	(1)	(1)	(1)
	212 060	(252 692)	(184 693)	(150 734)	(61 344)

\* Le chiffre pour 1912 se rapport aux exportations des ports d'Haïfa, Jafia, Mersina, Adalia, Aya et Smyrne. — (1) Chiffres non disponibles. — (2) 11 mois.



## MOUVEMENT DE SÉSAME PAR PAYS IMPORTATEURS.

Pays.	1912.	1913.	1914.	1915.	1916.
	1000 kg.	1000 kg.	1000 kg.	1000 kg.	1000 kg.
Allemagne :					
importation.....	99 282	116 039 (2)	88 237	(1)	(1)
Autriche-Hongrie :					
importation.....	31 414	26 629 (2)	17 189	(1)	(1)
exportation.....	4	455 (2)	1	(1)	(1)
Danemark :					
importation.....	31 410	26 174 (2)	17 188	(1)	(1)
France :					
importation.....	2 544	4 018 (2)	4 396	(1)	(1)
exportation.....	19 611	20 586	21 675	15 874 (3)	58 490
	1 414	925	708	1 955	375
Italie * :					
importation.....	18 197	19 661	20 967	13 919 (3)	58 115
exportation.....	25 358	24 774	28 863	41 271 (4)	43 101
	27	16	26	46 (4)	57
Japon :					
importation.....	25 331	24 758	28 837	41 225 (4)	43 044
Pays-Bas :					
importation.....	5 970	5955	6 744	11 921 (1)	8 330
Russie :					
importation.....	(1)	(1)	(1)	(1)	(3) 25 703
	3 999	(1)	(1)	(1)	(1)

\* Sésame et arachide. — (1) Chiffres non disponibles. — (2) 1<sup>er</sup> semestre. — (3) 11 mois. — (4) 10 mois.

PRODUCTION DE TOURTEAUX DE SÉSAME DANS LES PAYS IMPORTATEURS  
(évaluée d'après les disponibilités de sésame).

Pays.	1912.	1913.	1914.	1915.	1916.
	1000 kg.	1000 kg.	1000 kg.	1000 kg.	1000 kg.
Allemagne.....	49 641	58 019 (2)	44 118	(1)	(1)
Autriche-Hongrie.....	15 705	13 087 (2)	8 594	(1)	(1)
Danemark.....	1 272	2 009 (2)	2 198	(1)	(1)
France.....	9 098	9 830	10 483	6 959 (3)	29 057
Italie *.....	12 665	12 379	14 418	20 612 (4)	21 522
Japon.....	2 985	2 977	3 372	5 960 (4)	4 165
Pays-Bas.....	(1)	(1)	(1)	(1)	(3) 12 851
Russie.....	1 999	(1)	(1)	(1)	(1)

\* Sésame et arachide. — (1) Chiffres non disponibles. — (2) 1<sup>er</sup> semestre. — (3) 11 mois. — (4) 10 mois.

## Soja.

## MOUVEMENT DE SOJA.

Pays.	1912.	1913.	1914.	1915.	1916.
	1000 kg.	1000 kg.	1000 kg.	1000 kg.	1000 kg.
a) Pays producteurs.					
Chine:					
exportation .....	661 004	624 236	674 795	709 702	(1)
Chorée:					
exportation .....	98 674	95 537	68 825	123 141 (2)	58 097
Japon:					
production .....	6 334 365	5 389 274	6 612 523	(1)	(1)
importation .....	129 725	106 831	150 965	118 824 (3)	60 198
exportation .....			441	475 (3)	642
b) Pays importateurs.					
Allemagne:					
importation .....	96 268	106 066 (4)	64 235	(1)	(1)
Belgique:					
importation .....	444	4 753	(1)	(1)	(1)
Danemark:					
importation .....	33 981	48 069	(1)	(1)	(1)
États-Unis:					
importation .....			875	1 741 (3)	54 013
France:					
importation .....	17	45	(1)	(1)	(1)
Pays-Bas:					
importation .....	45 053	27 554	19 619	16 551 (5)	4 080
exportation .....	16 545	14 422	14 037	128 (5)	0
	28 508	13 132	5 582	16 423	4 080
Royaume-Uni:					
importation .....	191 789	77 679	72 303	173 653	66 413
réexportation .....	1 651	816	9 543	1 714	(1)
Russie:					
importation .....	360	393	164	49 (3)	5
Suède:					
importation .....	2	—	—	49	(1)

(1) Chiffres non disponibles. — (2) 7 mois. — (3) 10 mois. — (4) 1<sup>er</sup> semestre. — (5) 11 mois.

## MOUVEMENT DE TOURTEAUX DE SOJA.

Pays.	1912.	1913.	1914.	1915.	1916.
	1000 kg.	1000 kg.	1000 kg.	1000 kg.	1000 kg.
a) Pays producteurs.					
Chine:					
exportation .....	493 477	714 460	651 045	700 882	(1)
Chorée:					
exportation .....	1 063	1 514	4	0 (2)	9
Japon:					
production .....			92 333	(1)	(1)
importation .....	518 056	726 920	627 636	741 515	(3) 674 403
b) Pays importateurs.					
Allemagne:					
importation .....	7 080	3 260	1 201	(1)	(1)
Danemark:					
importation .....	14 767	19 262	4 964	(1)	(1)
exportation .....	6 555	5 868	(1)	(1)	(1)
	8 212	13 394	(4 964)	(1)	(1)
Etats-Unis:					
importation .....	1 096	3 177	1 435	2 710	(1)
France:					
importation .....	1 952	400	230	(1)	(1)
Pays-Bas:					
importation .....	23 852	7 230	1 230	(1)	(1)
Royaume-Uni:					
exportation .....	475	304	90	189	39
Russie:					
importation .....	2 059	21 969	195	(1)	(1)
Suède:					
importation .....	9 979	7 437	3 665	(1)	(1)

(1) Chiffres non disponibles. — (2) 7 mois. — (3) 10 mois.



## PRODUCTION DE TOURTEAUX DE SOJA DANS LES PAYS IMPORTATEURS

(évaluée d'après les disponibilités de soja).

Pays,	1912.	1913.	1914.	1915.	1916.
	1000 kg.	1000 kg.	1000 kg.	1000 kg.	1000 kg.
Allemagne.....	77 014	84 853	51 388	(1)	(1)
Belgique.....	355	3 802	(1)	(1)	(1)
Danemark.....	27 185	38 455	(1)	(1)	(1)
États-Unis.....			700	1 393 (2)	43 210
France.....	14	36	(1)	(1)	(1)
Pays-Bas.....	14 254	10 506	4 466	13 138 (3)	3 264
Royaume-Uni.....	143 431	62 143	57 842	138 922	53 130
Russie.....	288	314	131	39 (2)	4

(1) Chiffres non disponibles. — (2) 10 mois. — (3) 11 mois.

En présentant pour la première fois, en tableaux d'ensemble, les chiffres concernant le mouvement international du soja et de son tourteau, il convient de faire quelques remarques.

Avant tout il faut signaler le fait que le marché du soja et de ses produits, de restreint qu'il était à l'Extrême-Orient (Chine, Japon) est devenu, ces dernières années, international (Extrême-Orient, Europe, Amérique septentrionale).

La nature même de ce marché a changé : tandis que le soja continue à voyager entre les pays de l'Extrême-Orient comme matière première fournissant des produits d'alimentation humaine et des résidus d'extraction de l'huile comme engrais organique azoté par excellence, dans le transit intercontinental il constitue une marchandise pour cargaison de retour, recherchée principalement pour l'huile qu'elle contient et pour le résidu de l'extraction de celle-ci, lequel représente un aliment des plus concentrés par son taux très élevé d'albuminoïdes ; et l'utilisation du soja dans ce sens a engendré une nouvelle industrie (Allemagne, Angleterre, Danemark, Pays-Bas), dont le développement a été en partie entravé par les difficultés de transport actuelles.

De toutes façons, il ne faut pas perdre de vue la différence essentielle existant, dans l'emploi des tourteaux de soja et d'autres encore, entre l'Europe et l'Extrême-Orient : ici ces tourteaux constituent principalement un engrais azoté (riz, canne à sucre), là ils représentent un aliment des plus concentrés pour le bétail.

## Coprah.

## EXPORTATIONS DE COPRAH PAR PAYS PRODUCTEURS.

Pays.	1912.	1913.	1914.	1915.	1916.
	1000 kg.	1000 kg.	1000 kg.	1000 kg.	1000 kg.
Colonies allemandes :					
Est-africain all.....	4 242	(1)	(1)	(1)	(1)
Togo.....	163	( )	(1)	(1)	(1)
Nouv.-Guinée et dép.....	17 391	(1)	(1)	(1)	(1)
Samoa .....	11 201	(1)	(1)	(1)	(1)
	32 997	(1)	(1)	(1)	(1)
Etats-Unis, dép. Philippines....	141 200	76 000	87 344	139 092	(1)
Colonies françaises :					
Côte d'Ivoire.....	22	2	(1)	(1)	(1)
Dahomey et dép.....	301	236	199	213	(1)
Gabon.....	1	1	(1)	(1)	(1)
Indochine.....	7 982	5 645	8 414	7 864	(1)
Nouv.-Calédonie et dép.....	2 856	3 216	3 104	4 323	(1)
Etabliss. franç. de l'Océanie...	6 113	9 010	(1)	(1)	(1)
	17 275	18 110	(11 717)	(12 400)	(1)
Territoires britanniques :					
Inde (an. fin. le 31 mars).....	32 387	34 901	38 804	32 356 (2)	15 839
Ceylan.....	31 197	59 555	71 730	61 396	(1)
Etats Malais féd. ....	7 831	9 436	14 732	6 316 (3)	3 110
Bornéo brit. ....	569	655	998	(1)	(1)
Sarawak .....	103	71	152	(1)	(1)
Seychelles.....	2 735	2 984	3 671	2 887	(1)
Maurice.....	8	99	(1)	(1)	(1)
Tonga.....	11 298	3 481	4 449	(1)	(1)
Fiji.....	13 930	8 056	(1)	15 482	(1)
Papouasie (an. fin. le 31 mars) ..	1 009	807	1 220	(1)	(1)
Iles Salomon brit.....	4 095	3 645	5 898	5 431	(1)
Est-afr. brit. (an. fin. le 31 mars).	1 611	1 589	1 612	(1)	(1)
Zanzibar.....	9 482	9 603	10 138	8 722	(1)
Côte de l'Or.....	630	640	667	782	(1)
Nigérie.....	96	98	(1)	(1)	(1)
Trinité et Tobago.....	1 433	524	1 070	1 808	(1)
Sainte-Lucie.....	1	4	7	(1)	(1)
Jamaïque.....	21	32	83	509	(1)
Guyane brit.....	58	56	86	82 (4)	81
	118 494	136 236	(155 317)	(135 771)	(19 030)
Colonies néerlandaises :					
Java.....	84 650	80 268	68 343	58 382	(1)
Macassar.....	37 822				(1)
Sangir, Menado, Gorontalo...	30 076	113 547	130 145	112 086	(1)
Padang.....	17 351				(1)
	169 899	193 815	198 488	170 468	(1)
Colonies portugaises :					
Est-africain portugais.....	4 732	4 035	(1)	(1)	(1)
Saint-Domingue.....	(1)	(1)	(1)	120	(1)
Siam.....	(1)	(1)	(1)	33	(1)
	(484 597)	(428 196)	(452 866)	(450 020)	(19 030)

(1) Chiffres non disponibles. — (2) 11 mois. — (3) 3 mois. — (4) 8 mois.

## MOUVEMENT DE COPRAH PAR PAYS IMPORTATEURS.

Pays.	1912.	1913.	1914.	1915.	1916.
	1000 kg.	1000 kg.	1000 kg.	1000 kg.	1000 kg.
Allemagne:					
importation.....	183 258	196 449 (2)	82 956	(1)	(1)
exportation.....	981	549 (2)	573	(1)	(1)
	182 277	195 900 (2)	82 383	(1)	(1)
Autriche-Hongrie:					
importation.....	45 537	33 305 (2)	14 882	(1)	(1)
Belgique:					
importation.....	25 774	19 552 (2)	11 118	(1)	(1)
exportation.....	7 170	6 957 (2)	4 707	(1)	(1)
	18 604	12 595 (2)	6 411	(1)	(1)
Danemark:					
importation.....	24 595	31 144 (2)	13 690	(1)	(1)
Etats-Unis:					
importation.....	30 940	17 826	31 066	51 354 (4)	57 900
France:					
importation.....	153 506	112 640	96 363	131 371 (5)	97 720
exportation.....	92	312	68	369 (5)	389
	153 414	112 328	96 295	131 002 (5)	97 331
Royaume-Uni:					
importation.....	(3)	14 432	42 837	120 021	(3)
Italie:					
importation.....	58	90	3 108	14 641 (4)	6 391
exportation.....	0	0	0	702 (4)	0
	58	90	3 108	13 939 (4)	6 391
Japon:					
importation.....	2 908	2 558	3 038	4 121 (4)	12 144
Pays-Bas:					
importation.....	102 230	100 635	109 420	210 288 (5)	78 515
exportation.....	78 350	82 356	77 108	106 845 (5)	0
	23 880	18 279	32 312	103 443 (5)	78 515
Russie:					
importation.....	63 906	(1)	(1)	(1)	(1)

(1) Chiffres non disponibles. — (2) 1<sup>er</sup> semestre. — (3) Non spécifié. — (4) 10 mois. — (5) 11 mois.



**PRODUCTION DE TOURTEAUX DE COPRAH DANS LES PAYS IMPORTATEURS**  
(évaluée d'après les disponibilités de coprah).

Pays.	1912.	1913.	1914.	1915.	1916.
	1000 kg.	1000 kg.	1000 kg.	1000 kg.	1000 kg.
Allemagne.....	91 138	97 950 (2)	41 191	(1)	(1)
Autriche-Hongrie.....	22 768	16 652 (2)	7 441	(1)	(1)
Belgique.....	9 302	6 297 (2)	3 205	(1)	(1)
Danemark.....	12 272	15 572 (2)	6 845	(1)	(1)
Etats-Unis.....	15 470	8 913	15 533	25 677 (3)	28 950
France.....	76 707	56 164	48 147	65 509 (4)	48 215
Royaume-Uni.....	.....	7 216	21 418	60 010	.....
Italie.....	29	45	1 554	6 969 (3)	3 195
Japon.....	1 454	1 279	1 519	2 060 (3)	6 072
Pays-Bas.....	11 940	9 139	16 156	51 721 (4)	39 257
Russie.....	31 953	(1)	(1)	(1)	(1)

(1) Chiffres non disponibles. — (2) 1<sup>er</sup> semestre. — (3) 10 mois. — (4) 11 mois.

**Palmiste.**

**EXPORTATIONS D'AMANDES DE PALME PAR PAYS PRODUCTEURS.**

Pays.	1912.	1913.	1914.	1915.	1916.
	1000 kg.	1000 kg.	1000 kg.	1000 kg.	1000 kg.
<b>Colonies allemandes :</b>					
Cameroun.....	15 999	(1)	(1)	(1)	(1)
Togo.....	11 639	(1)	(1)	(1)	(1)
	27 638	(1)	(1)	(1)	(1)
Congo belge.....	5 895	7 207	(1)	(1)	(1)
<b>Colonies françaises :</b>					
Sénégal.....	1 764	1 901	1 501	1 724	(1)
Haut-Sénégal et Niger *.....	847	475	2 275	(1)	(1)
Guinée française.....	5 135	5 172	4 726	5 829	(1)
Côte d'Ivoire.....	6 799	6 949	5 652	6 113	(1)
Dahomey et dép.....	37 296	26 371	21 578	23 370	(1)
Moyen-Congo.....	.....	.....	162	559	(1)
Gabon.....	359	575	809	609	(1)
Indochine.....	42	.....	(1)	(1)	(1)
	52 242	41 443	(36 703)	(38 204)	(1)
<b>Territoires britanniques :</b>					
Nigérie.....	187 587	177 524	165 058	156 370	164 165
Sierra Leone.....	51 574	49 991	36 491	44 028	(1)
Côte de l'Or.....	14 864	9 899	5 723	4 129	(1)
Gambie.....	452	554	503	331	(1)
	254 477	237 968	207 775	204 858	(164 165)
<b>Colonies portugaises :</b>					
Guinée portugaise.....	6 065	6 626	(1)	(1)	(1)
S. Thomé et Príncipe.....	1 013	1 241	1 264	(1)	(1)
	7 078	7 867	(1 264)	(1)	(1)
	347 330	(294 485)	1/2(245 742)	(243 062)	(164 165)

(\*) Amandes de karité. — (1) Chiffres non disponibles.

## MOUVEMENT D'AMANDES DE PALME PAR PAYS IMPORTATEURS.

Pays.	1912.	1913.	1914.	1915.	1916.
	1000 kg.	1000 kg.	1000 kg.	1000 kg.	1000 kg.
Allemagne :					
importation.....	261 408	235 917	(2) 113 205	(1)	(1)
Autriche-Hongrie :					
importation.....	39 906	27 043	(2) 1 127	(1)	(1)
Belgique :					
importation.....	6 402	4 265	(2) 2 262	(1)	(1)
exportation.....	565	790	(2) 698	(1)	(1)
	5 837	3 475	1 564	(1)	(1)
Danemark :					
importation.....	1 773	595	(2) 406	(1)	(1)
France :					
importation.....	2 077	2 986	3 135	18 463	(4) 16 234
exportation.....	40	12	7	4	(4) 271
	2 037	2 974	3 128	18 459	(4) 15 963
Royaume-Uni :					
importation.....	(3)	(3)	75 997	236 992	* 379 004
réexportation.....	(3)	(3)	9 332	24 565	(3)
Italie :					
importation ** .....	254	110	343	519	(5) 478
Pays-Pas :					
importation.....	56 863	63 711	56 187	25 829	(4) 28 842
exportation.....	48 439	57 563	35 534	83	(4) 0
	8 424	6 148	20 653	25 746	(4) 28 842

\* Y compris coprah et autres fruits oléagineux. — \*\* De *Bassia*, *Stillingia* et palme — (1) Chiffres non disponibles. — (2) 1<sup>er</sup> semestre. — (3) Non spécifié. — (4) 11 mois. — (5) 10 mois.

PRODUCTION DE TOURTEAUX DE PALMISTE DANS LES PAYS IMPORTATEURS  
(évaluée d'après les disponibilités d'amanes de palme).

Pays.	1912.	1913.	1914.	1915.	1916.
	1000 kg.	1000 kg.	1000 kg.	1000 kg.	1000 kg.
Allemagne.....	130 704	117 958	(2) 56 602	(1)	(1)
Autriche-Hongrie.....	19 953	13 521	(2) 563	(1)	(1)
Belgique.....	2 918	1 737	(2) 782	(1)	(1)
Danemark.....	886	297	(2) 203	(1)	(1)
France.....	1 018	1 487	1 564	9 229	(3) 7 981
Royaume-Uni.....			37 998	118 496	* 189 502
Italie.....	127	55	171	259	(4) 238
Pays-Bas.....	4 212	3 074	10 326	12 873	(3) 14 421

\* Y compris coprah, etc. — (1) Chiffres non disponibles. — (2) 1<sup>er</sup> semestre. — (3) 11 mois. — (4) 10 mois.

## Résidus de la sucrerie.

PRODUCTION DE RÉSIDUS DE BETTERAVE  
(évaluée d'après la production de betterave sucrière).

Pays.	1912.	1913.	1914.	1915.	1916.
	1000 kg.	1000 kg.	1000 kg.	1000 kg.	1000 kg.
a) Cossettes (matière sèche).					
Allemagne .....	832 110	847 000	845 939	505 900	.....
Autriche.....	396 190	348 100	338 742	.....	.....
Hongrie .....	241 985	243 250	200 715	124 425	.....
Belgique.....	86 515	69 595	.....	.....	.....
Bulgarie.....	3 065	4 250	15 000	.....	.....
Danemark.....	49 300	46 500	48 364	41 300	.....
Espagne.....	39 590	59 100	32 146	36 178	27 274
Etats-Unis .....	236 975	256 690	239 882	330 774	338 902
France.....	361 105	301 505	187 553	57 403	95 498
Australie .....	205	320	378	525	.....
Canada.....	9 115	6 715	4 926	6 396	3 221
Italie.....	87 150	136 500	67 500	74 330	65 000
Pays-Bas.....	108 805	83 265	99 709	83 307	95 940
Roumanie.....	14 610	14 120	11 248	.....	.....
Russie d'Europe .....	536 200	617 585	.....	.....	.....
Serbie.....	7 500	.....	.....	.....	.....
Suède.....	42 325	42 260	43 863	38 832	.....
Suisse.....	.....	1 580	1 350	1 250	1 000

## b) Mélasses.

Allemagne.....	332 844	338 800	338 376	202 300	.....
Autriche.....	158 476	139 240	135 497	.....	.....
Hongrie .....	96 794	97 300	80 286	49 770	.....
Belgique.....	34 606	27 838	.....	.....	.....
Bulgarie.....	1 226	1 700	6 000	.....	.....
Danemark.....	19 720	18 600	19 346	16 520	.....
Espagne.....	15 836	23 640	12 858	14 471	10 910
Etats-Unis .....	94 790	102 676	95 953	132 310	135 561
France.....	144 442	120 602	75 021	22 961	28 199
Australie .....	82	128	151	210	.....
Canada.....	3 646	2 686	1 970	2 558	1 288
Italie.....	34 860	54 600	27 000	29 732	26 000
Pays-Bas.....	43 522	33 306	39 884	33 323	38 376
Roumanie.....	5 844	5 648	4 499	.....	.....
Russie d'Europe .....	214 480	247 034	.....	.....	.....
Serbie.....	3 000	.....	.....	.....	.....
Suède.....	16 930	16 904	17 545	15 533	.....
Suisse.....	.....	632	540	500	400



### Résidus de la brasserie.

En se basant sur les derniers chiffres disponibles concernant la production de bière dans les principaux pays producteurs, on peut commencer à établir les rendements en résidus utilisables comme aliments pour le bétail. Ces résidus sont rangés sous 3 rubriques principales :

- a) *Touraillons*, à taux moyen calculé de 88 % de matière sèche ;
- b) *Drèches desséchées*, à taux moyen calculé de 91 % de matière sèche ;
- c) *Résidus divers* : levures, lies, houblon épuisé ; on peut admettre que  $\frac{5}{11}$  en sont constitués par les levures et les lies desséchées à 89 % de matière sèche, et  $\frac{6}{11}$  par le houblon épuisé à 25 % de matière sèche.

### PRODUCTION DE RÉSIDUS DE LA BRASSERIE DANS LE MONDE

(évaluée d'après la production en bière).

Pays.	Touraillons.	Drèches desséchées.	Résidus divers.
	1000 kg.	1000 kg.	1000 kg.
Allemagne (1912-13).....	67 817	406 903	67 817
Argentine (1911).....	1 002	6 015	1 002
Autriche-Hongrie (1912).....	24 717	148 303	24 717
Belgique (1912).....	16 000	96 000	16 000
Bulgarie (1912).....	230	1 380	230
Chili (1910).....	600	3 600	600
Danemark (1912).....	2 448	14 689	2 448
Espagne (1911).....	390	2 340	390
Etats-Unis (1912-13).....	76 533	459 198	76 533
France (1912).....	15 822	94 932	15 822
Royaume-Uni (1911-12).....	59 058	354 347	59 058
Grèce (1911).....	92	555	92
Italie (1911-12).....	710	4 260	710
Japon (1911).....	253	1 521	253
Norvège (1912).....	530	3 180	530
Pays-Bas (1912).....	1 920	11 520	1 920
Roumanie (1911-12).....	310	1 861	310
Russie et Finlande (1911).....	11 444	68 661	11 444
Serbie (1911).....	148	889	148
Suède (1911-12).....	2 739	16 434	2 739
Suisse (1912).....	3 100	18 600	3 100
Autres Pays.....	7 000	42 000	7 000
TOTAUX ..	292 863	1 757 188	292 863

# COMMERCE INTERNATIONAL DES ALIMENTS CONCENTRÉS POUR LE BÉTAIL

## Produits immédiats de l'agriculture.

COMMERCE EXTÉRIEUR DES GRAINS, GRAINES, FRUITS ET FÉCULENTS EMPLOYÉS  
COMME ALIMENTS CONCENTRÉS POUR LE BÉTAIL.

Pays.	Importation.				
	1912.	1913.	1914.	1915.	1916.
	1000 kg.	1000 kg.	1000 kg.	1000 kg.	1000 kg.
Allemagne :					
orge .....	2 756 925	3 087 067	1 160 495	(2)	(2)
féveroles .....	25 565	15 290	(1) 7 040	(2)	(2)
lupins .....	13 280	6 689	(1) 8 557	(2)	(2)
vesces .....	25 181	15 263	(1) 12 000	(2)	(2)
Autriche-Hongrie :					
vesces .....	6 167	565	(1) 2 762	(2)	(2)
Belgique :					
grains et leurs dérivés non alimentaires, autres que le son ..	1 691	1 344	(1) 544	(2)	(2)
Brésil :					
farine de manioc .....					
Espagne :					
caroubes * .....	1 903	13 377	16 470	1 005	(2)
France :					
caroubes .....	24 150	18 087	10 933	13 176	18 780
manioc brut .....	23 850	20 051	19 084	10 594	13 548
Colonies françaises :					
Algérie :					
caroubes .....					
Indochine :					
manioc desséché .....					
Royaume-Uni :					
caroubes .....	66 087	31 667	38 030	47 858	(2)
Territoires britanniques :					
Chypre :					
caroubes .....					
Italie :					
caroubes .....	7 114	5 089	4 470	4 786 (3)	1 110
Pays-Bas :					
blé .....	17 905	21 616	(2)	(2)	(2)
seigle .....	5 575	6 554	(2)	(2)	(2)
orge .....	8 368	11 137	(2)	(2)	(2)
sarrasin .....	259	206	(2)	(2)	(2)
féveroles et vesces .....	389	(2)	(2)	(2)	(2)
Colonies néerlandaises :					
Indes orientales :					
racines desséchées .....					
et déchets de manioc .....					

\* A l'importation graines non dénommées et caroubes. — (1) 1<sup>er</sup> semestre. — (2) Chiffres non disponibles. — (3) 11 mois.

COMMERCE EXTÉRIEUR DES GRAINS, GRAINES, FRUITS ET FÉCULENTS EMPLOYÉS  
COMME ALIMENTS CONCENTRÉS POUR LE BÉTAIL, (Suisse).

Pays.	Exportation.				
	1912.	1913.	1914.	1915.	1916.
	1000 kg.	1000 kg.	1000 kg.	1000 kg.	1000 kg.
<b>Allemagne :</b>					
orge .....	1 157	6 018	(1) 2 216	(2)	(2)
féveroles .....	170	872	(1) 365	(2)	(2)
lupins .....	478	727	(1) 637	(2)	(2)
vesces .....	1 295	924	(1) 471	(2)	(2)
<b>Autriche-Hongrie :</b>					
vesces .....	3 748	2 306	(1) 696	(2)	(2)
<b>Belgique :</b>					
grain et leurs dérivés non ali- mentaires, autres que le son ..	3 748	2 306	(1) 696	(2)	(2)
<b>Brésil :</b>					
farine manioc .....	3 644	4 688	4 728	4 177	(2)
<b>Espagne :</b>					
caroubes * .....	565	44	85	1 158	(2)
<b>France :</b>					
caroubes .....	104	28	18	53	384
manioc brut .....					
<b>Colonies françaises :</b>					
Algérie :					
caroubes .....	6 922	2 658	3 004	3 144	3 859
Indochine :					
manioc desséché .....	1 468	1 493	3 030	—	(2)
<b>Royaume-Uni ;</b>					
caroubes .....					
<b>Territoires britanniques :</b>					
Chypre :					
caroubes .....	64 680	45 711	47 613	(2)	(2)
<b>Italie :</b>					
caroubes .....	5 166	4 354	4 640	1 427 (3)	1 798
<b>Pays-Bas :</b>					
blé .....	14 001	17 308	(2)	(2)	(2)
seigle .....	2 892	3 805	(2)	(2)	(2)
orge .....	6 520	8 507	(2)	(2)	(2)
sarrasin .....	59	6 768	(2)	(2)	(2)
féveroles et vesces .....	252	(2)	(2)	(2)	(2)
<b>Colonies néerlandaises :</b>					
Indes orientales :					
racines desséchées .....	12 903	141 58	6 541	(2)	(2)
et déchets de manioc .....	17 313	259 40	17 947	(2)	(2)

\* A l'importation graines non dénommées et caroubes. — (1) 1<sup>er</sup> semestre. — (2) Chiffres non disponibles. — (3) 11 mois.



**Résidus de la meunerie.**  
**COMMERCE EXTÉRIEUR DU SON (de blé ou autre).**

Pays.	Importation.					Exportation.				
	1912.	1913.	1914.	1915.	1916.	1912.	1913.	1914.	1915.	1916.
	1000 kg.	1000 kg.	1000 kg.	1000 kg.	1000 kg.	1000 kg.	1000 kg.	1000 kg.	1000 kg.	1000 kg.
Allemagne.....	1 606 250	1 414 256	(1) 610 703	(2)	(2)	16 708	23 284	(1) 13 139	(2)	(2)
Argentine.....	147 882	140 924	(1) 66 334	(2)	(2)	325 226	274 058	230 934	145 449	(5) 19 223
Autriche-Hongrie.....	55 776	73 174	(1) 45 843	(2)	(2)	37 183	30 891	(1) 23 680	(2)	(2)
Belgique.....	59 368	127 561	106 515	118 048	(2)	42 008	22 048	(1) 16 501	20 987	(2)
Brésil.....	55 277	45 222	29 401	(2)	(2)	54 424	54 814	43 782	45 700	(2)
Chine.....	1 555	5 209	68	8	(2)	45 137	62 109	25 863	(2)	(2)
Danemark.....	171 688	231 931	201 852	16 145	30 278	.....	.....	383	(2)	(2)
Espagne.....	209 674	232 666	248 472	419 030	191 760	3 999	215	400	1 301	(2)
Etats-Unis.....	2 048	424	(2)	(2)	(2)	85 290	4 670	5 281	18 740	(3) 5 272
France.....	.....	.....	.....	.....	.....	36 888	35 549	11 478	9 854	5 644
Algérie.....	.....	.....	.....	.....	.....	14 551	19 935	14 116	9 128	16 962
Tunisie.....	.....	.....	.....	.....	.....	2 586	.....	.....	.....	.....
Royaume-Uni.....	.....	.....	.....	.....	.....	317 121	162 018	84 118	2 679	2 186
Australie.....	.....	.....	.....	.....	.....	6 706	12 222	(2)	(2)	(2)
Canada (an. fin. le 31 mars)	.....	.....	.....	.....	.....	81 077	84 450	105 552	52 739	(2)
Inde britannique.....	2 764	3 850	2 582	2 673	(4) 4 057	244 291	244 250	193 326	196 351	(4) 7 639
Italie.....	9 187	10 618	4 287	4 007	(4) 5 569	28 155	31 823	37 275	5 378	(4) 2 649
Japon.....	28 184	39 558	14 989	18 450	(3) 7 367	.....	.....	.....	.....	.....
Norvège.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Pays-Bas.....	40 646	43 827	22 407	(2)	(2)	21 256	15 975	10 992	40	(2)
Indes or. néerlandaises.....	7 477	7 172	9 045	(2)	(2)	66 575	63 937	34 029	(2)	(2)
Russie.....	.....	.....	.....	.....	.....	585	324	494	(2)	(2)
Suède.....	58 485	55 780	46 386	(1) 20 420	(2)	835 207	794 000	448 300	78 249	(3) 62 442
Suisse.....	2 945	2 401	1 581	(2)	(2)	23 005	24 165	2 36	(2)	(2)
Uruguay.....	14 908	10 151	5 143	1 141	(5) 3 924	14 394	17 057	11 123	4 175	(5) 1 013
	.....	.....	.....	.....	.....	8 981	2 321	741	31	(2)

(1) 1<sup>er</sup> semestre. — (2) Chiffres non disponibles. — (3) 10 mois. — (4) 11 mois. — (5) 9 mois.

## COMMERCE EXTÉRIEUR DES RÉSIDUS DE RIZ (brisures et autres).

Pays.	Importation.					Exportation.				
	1912.	1913.	1914.	1915.	1916.	1912.	1913.	1914.	1915.	1916.
	1000 kg.	1000 kg.	1000 kg.	1000 kg.	1000 kg.	1000 kg.	1000 kg.	1000 kg.	1000 kg.	1000 kg.
Allemagne.....	213 741	206 475	(1) 87 450	(2)	(2)	7 285	4 068	(1) 3 635	(2)	(2)
Argentine.....	.....	.....	.....	.....	.....	2 159	2 574	1 301	.....	.....
Autriche-Hongrie.....	13 876	5 816	(1) 2 092	(2)	(2)	15 747	11 079	(1) 2 544	(2)	(2)
Danemark.....	3 380	4 495	(2)	(2)	(2)	.....	.....	.....	.....	.....
Etats-Unis.....	55 368	65 345	47 620	35 834	(3) 12 354	7 970	1 975	2 014	602	(3) 20
France.....	26 718	50 419	76 980	71 740	66 903	2 266	9 645	28 864	16 779	4 677
Indochine.....	.....	.....	.....	.....	.....	107 097	238 280	307 989	265 975	(2)
Australie.....	22	13	(2)	(2)	(2)	3 233	2 160	(2)	(2)	(2)
Japon.....	13 284	16 121	8 676	1 735	(3) 1 200	.....	.....	.....	.....	.....
Norvège.....	2 767	1 506	2 531	594	(4) 1 373	.....	.....	.....	.....	.....
Siam (an. fin. le 31 mars).	.....	.....	.....	.....	.....	287 808	271 987	563 837	(2)	(2)
Suède.....	5 069	4 907	1 299	(2)	(2)	268	315	319	(2)	(2)

(1) 1<sup>er</sup> semestre. — (2) Chiffres non disponibles. — (3) 10 mois. — (4) 8 mois.

## COMMERCÉ EXTÉRIEUR DES DÉCHETS DIVERS DE MEUNERIE (autres que le son).

Pays.	Importation.					Exportation.				
	1912.	1913.	1914.	1915.	1916.	1912.	1913.	1914.	1915.	1916.
	1000 kg.	1000 kg.	1000 kg.	1000 kg.	1000 kg.	1000 kg.	1000 kg.	1000 kg.	1000 kg.	1000 kg.
Argentine: résidus de maïs.....						1 742	1 656	1 299		
Autriche-Hongrie: farine-fourrage.....	12	2				780	1 148 (1)	1 065	(2)	(2)
Etats-Unis: farine-fourrage (mill feed).....						53 002	146 562	45 622	19 703 (3)	35 518
Italie: recoupes de blé dur (ré- exportation).....						22 627	27 336	25 492	1 966 (4)	5 331
Pays-Bas: recoupe.....	16 509	20 616	8 755	(2)	(2)	12 956	13 098	(2)	(2)	(2)
farine-fourrage (de blé, seigle, sarrasin).....	281 621	311 066	(2)	(2)	(2)	95 532	106 819	(2)	(2)	(2)
Suisse: farine-fourrage (dénat- turée).....	53 543	57 937	35 987	283 (5)	137	83	69	106	1 (5)	30
déchets de meunerie..	5 842	6 730	9 979	6 159 (5)	6 643	864	1 005	864	277 (5)	718

(1) 1<sup>er</sup> semestre. — (2) Chiffres non disponibles. — (3) 10 mois. — (4) 11 mois. — (5) 9 mois.



## Résidus de l'huilerie.

## COMMERCE EXTÉRIEUR DE TOURTEAUX (et farine) DE LIN.

Pays.	Importation.					Exportation.				
	1912.	1913.	1914.	1915.	1916.	1912.	1913.	1914.	1915.	1916.
	1000 kg.	1000 kg.	1000 kg.	1000 kg.	1000 kg.	1000 kg.	1000 kg.	1000 kg.	1000 kg.	1000 kg.
Autriche-Hongrie.....	3 882	4 989	(1) 1 829	(2)	(2)	15 304	18 245	(1) 11 900	(2)	(2)
Danemark.....	11 334	66 338	67 232	(2)	(2)	272	471	286	(2)	(2)
Espagne.....	.....	.....	.....	.....	.....	1 412	759	418	519	(2)
Etats-Unis.....	.....	.....	.....	.....	.....	319 791	394 502	230 966	275 037	(3) 251 816
Royaume-Uni.....	55 135	83 679	47 855	66 647	195 017	4 977	5 551	3 796	96	61
Pays-Bas.....	261 099	275 122	220 849	210 624	(4) 148 383	.....	.....	.....	.....	.....
Suède.....	2 192	4 359	1 621	(2)	(2)	313	224	.....	.....	.....

(1) 1<sup>er</sup> semestre. — (2) Chiffres non disponibles. — (3) 10 mois. — (4) 11 mois.

## COMMERCE EXTÉRIEUR DES TOURTEAUX (et farine) DE GRAINES DE COTON.

Pays.	Importation.					Exportation.				
	1912.	1913.	1914.	1915.	1916.	1912.	1913.	1914.	1915.	1916.
	1000 kg.	1000 kg.	1000 kg.	1000 kg.	1000 kg.	1000 kg.	1000 kg.	1000 kg.	1000 kg.	1000 kg.
Danemark.....	242 856	234 795	178 870	(2)	(2)	.....	.....	.....	.....	.....
Etats-Unis.....	.....	.....	.....	.....	.....	543 470	455 893	285 355	661 539	(3) 410 973
Royaume-Uni.....	286 413	240 522	186 083	220 954	195 017	5 967	7 887	4 501	3 155	519
Pays-Bas.....	35 650	25 276	10 851	2 132	(4) 439	.....	.....	.....	.....	.....
Pérou.....	.....	.....	.....	.....	.....	5 473	5 820	5 930	(2)	(2)
Suède.....	17 804	9 485	13 080	(2)	(2)	172	1 704	1	(2)	(2)

(1) 1<sup>er</sup> semestre. — (2) Chiffres non disponibles. — (3) 10 mois. — (4) 11 mois.

## COMMERCE EXTÉRIEUR DES TOURTEAUX DIVERS (non dénommés ou autres).

Pays.	Importation.					Exportation.				
	1912.	1913.	1914.	1915.	1916.	1912.	1913.	1914.	1915.	1916.
	1000 kg.	1000 kg.	1000 kg.	1000 kg.	1000 kg.	1000 kg.	1000 kg.	1000 kg.	1000 kg.	1000 kg.
Allemagne.....	794 190	828 492	(1) 367 317	(2)	(2)	263 623	294 174	(1) 171 319	(2)	(2)
Argentine.....	.....	.....	.....	.....	.....	17 622	20 952	17 403	18 479	(3) 8 435
Autriche-Hongrie.....	42 602	32 219	(1) 12 157	(2)	(2)	29 725	31 235	(1) 16 884	(2)	(2)
Belgique.....	242 354	255 952	(1) 116 514	(2)	(2)	71 423	56 810	(1) 29 731	(2)	(2)
Chine.....	161	19	14	.....	.....	544 543	793 836	81 033	72 708	.....
Danemark.....	255 003	275 813	198 430	.....	.....	9 590	13 744	5 250	.....	.....
Egypte.....	.....	.....	.....	.....	.....	80 778	62 977	79 987	111 670	83 247
Etats-Unis.....	.....	.....	.....	.....	.....	.....	10 866	5 085	8 061	(4) 11 374
France.....	154 968	101 573	72 711	3 785	1 882	.....	214 801	179 917	110 081	112 716
Algérie.....	3 909	2 684	2 112	1 768	1 236	.....	.....	.....	.....	.....
Royaume-Uni.....	45 381	78 288	89 546	118 798	17 866	.....	.....	.....	.....	.....
Australie.....	458	146	(2)	(2)	(2)	.....	.....	.....	.....	.....
Ceylan.....	.....	.....	.....	.....	.....	.....	35 867	24 494	8 457	1 168
Inde britannique.....	18	52	500	462 (5)	199	60 293	32	(2)	(2)	(2)
Nigérie.....	.....	.....	.....	.....	.....	2 575	3 704	(2)	(2)	(2)
Union de l'Afrique du Sud	.....	.....	.....	.....	.....	150 656	181 676	151 342	152 285	(5) 122 571
Italie.....	3 913	2 957	1 121	638 (5)	675	.....	4 910	1 254	(2)	(2)
Japon.....	610 489	744 093	2 167 626	830 831 (4)	48 670	2 136	2 810	903	(2)	(2)
Norvège.....	29 665	30 122	37 973	32 276 (6)	29 383	26 194	19 662	54 693	5 726	(5) 14 711
Pays-Bas.....	76 451	47 283	21 510	26 933 (5)	32 223	.....	.....	.....	.....	.....
Indes or. néerlandaises.....	221	693	707	(2)	(2)	342	3 770	1 075	610	(6) 1
Russie.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Suède.....	154 853	145 416	108 895 (1)	82 171	(2)	4 028	4 952	4 427	(2)	(2)
Suisse.....	34 091	29 928	17 608	17 339 (3)	21 063	556 161	731 200	424 400	72 877	(4) 65 866
	.....	.....	.....	.....	.....	.....	143	28	.....	.....
	.....	.....	.....	.....	.....	956	1 015	419	21	(3) 1

(1) 1<sup>er</sup> semestre. — (2) Chiffres non disponibles. — (3) 9 mois. — (4) 10 mois. — (5) 11 mois. — (6) 8 mois.

**Résidus de la sucrerie.**  
**COMMERCE EXTÉRIEUR DES RÉSIDUS DE SUCRERIE.**

Pays.	Importation.					Exportation.				
	1912.	1913.	1914.	1915.	1916.	1912.	1913.	1914.	1915.	1916.
	1000 kg.	1000 kg.	1000 kg.	1000 kg.	1000 kg.	1000 kg.	1000 kg.	1000 kg.	1000 kg.	1000 kg.
Allemagne:										
cossettes de betterave.	51 500	25 819	(1) 5 878	(2)	(2)	4 382	7 672	(1) 1 704	(2)	(2)
Autriche-Hongrie:										
cossettes de betterave.	13 367	11 277	(1) 6 615	(2)	(2)	17 462	18 086	(1) 413	(2)	(2)
Danemark:										
mélasse .....	13	9	(2)	(2)	(2)	84	197	(2)	(2)	(2)
fourrage mélassé .....	2 552	938	(2)	(2)	(2)	4 622	4 261	(2)	(2)	(2)
France :										
pulpes séchées de bett.	42 938	1	6	13	2	962	488	648	154	22
Guyane britannique:										
« molascuit » .....						5 198	6 970	2 466	2 269 (3)	1 321
Maurice :										
« molascuit » .....						376	434	(2)	(2)	(2)
Norvège:										
mélasse .....	5 958	6 704	7 987	6 996 (3)	4 310					
Indes or. néerlandaises:										
« molascuit » .....						3 536	18 208	12 355	(2)	(2)
Suède:										
fourrages mélassés ....	6 712	4 980	3 345	(2)	(2)	1 136		541	(2)	(2)

(1) 1<sup>er</sup> semestre — (2) Chiffres non disponibles. — (3) 8 mois.



# Résidus des industries de fermentation et industries connexes. COMMERCE EXTÉRIEUR DES RÉSIDUS DE BRASSERIE (tourillons, etc.).

Pays.	Importation.					Exportation.				
	1912.	1913.	1914.	1915.	1916.	1912.	1913.	1914.	1915.	1916.
	1000 kg.	1000 kg.	1000 kg.	1000 kg.	1000 kg.	1000 kg.	1000 kg.	1000 kg.	1000 kg.	1000 kg.
Allemagne .....	146 528	157 256 (1)	69 999	(2)	(2)	894	297	1 462	.....	(2)
Argentine .....	.....	.....	.....	.....	.....	1 253	1 210 (1)	408	(2)	(2)
Autriche-Hongrie .....	2 538	2 104 (1)	1 285	(2)	(2)	166	84	(2)	(2)	(2)
Danemark .....	742	678	(2)	(2)	(2)	72 987	81 925	29 607	2 256 (3)	1 591
Etats-Unis .....	.....	.....	.....	.....	.....	5 232	5 704	(2)	(2)	(2)
Royaume-Uni .....	4 091	4 345	(2)	(2)	(2)	2 337	1 542	(2)	(2)	(2)
Australie .....	2	2	(2)	(2)	(2)	3 954	4 194	4 221	2 961 (4)	167
Suisse .....	5 513	6 153	3 878	1 292 (4)	954	.....	.....	.....	.....	.....

(1) 1<sup>er</sup> semestre. — (2) Chiffres non disponibles. — (3) 10 mois. — (4) 10 mois.

## COMMERCE EXTÉRIEUR DES RÉSIDUS DE DISTILLERIE, FÉCULIERIE, ETC. (drêches sèches, etc.).

Pays.	Importation.					Exportation.				
	1912.	1913.	1914.	1915.	1916.	1912.	1913.	1914.	1915.	1916.
	1000 kg.	1000 kg.	1000 kg.	1000 kg.	1000 kg.	1000 kg.	1000 kg.	1000 kg.	1000 kg.	1000 kg.
Allemagne .....	6 747	68 900 (1)	29 267	(2)	(2)	3 044	5 178 (1)	4 031	(2)	2
Autriche-Hongrie .....	3 421	4 307 (1)	2 000	(2)	(2)	325	239 (1)	176	(2)	(2)
Danemark (gluten) .....	306	21	(2)	(2)	(2)	.....	.....	.....	.....	.....
Etats-Unis (tourteaux et farine de germes de maïs) .....	.....	.....	.....	.....	.....	32 530	33 556	22 253	14 124 (3)	7 564
France .....	42 743	65 887	31 213	5 862	1 069	41 460	26 463	19 733	8 923	8 426
Suède (résidus du travail de graines de maïs) .....	10 658	13 767	11 475 (1)	18 758*	(2)	3 954	4 194	4 221 (1)	45*	(2)

(1) 1<sup>er</sup> semestre. — (2) Chiffres non disponibles. — (3) 10 mois. — \* Y compris autres produits.

## Résidus d'origine animale.

## COMMERCE EXTÉRIEUR DE FARINE DE VIANDE ET DE POISSON.

Pays.	Importation.					Exportation.				
	1912.	1913.	1914.	1915.	1916.	1912.	1913.	1914.	1915.	1916.
	1000 kg.	1000 kg.	1000 kg.	1000 kg.	1000 kg.	1000 kg.	1000 kg.	1000 kg.	1000 kg.	1000 kg.
Argentine :										
farine de viande . .	.....	.....	.....	.....	.....	3 374	2 744	1 701	354 <sup>2)</sup>	145
Danemark :										
farine de viande . .	56	304	(1)	(1)	(1)	.....	.....	.....	.....	..
Norvège :										
farine de poisson .	.....	.....	.....	.....	.....	14 548	8 929	8 978	10 448 <sup>3)</sup>	5 242
Paraguay :										
farine de viande .	.....	.....	.....	.....	.....	(1)	34	43	(1)	(1)
Uruguay :										
farine de viande .	.....	.....	.....	.....	.....	1 900	1 500	1 000	46	(1)

(1) Chiffres non disponibles. — (2) 9 mois. — (3) 8 mois.

PRIX EN GROS DE CERTAINS ALIMENTS  
CONCENTRÉS POUR LES BÉTAIL.

Par suite des conditions actuelles du marché monétaire international, notables sont les écarts entre la valeur en francs au pair et celle des cotes pour les divers marchés. Aussi, dans le but d'avoir des données comparables, avons-nous réduit en francs-or les cotes en francs au pair. Considérant les livres sterling comme pratiquement équivalentes à l'or, nous nous sommes servis des changes à Londres, que l'on trouvera dans le tableau suivant ; d'où l'on obtient les coefficients de transformation en divisant le change au pair par celui aux différentes dates considérées. Pour la commodité du lecteur, on donne aussi les coefficients de transformation qui permettent de calculer les prix en francs au pair, c'est-à-dire à leur valeur sur les marchés internes, en divisant les prix en francs-or par les coefficients, à la date respective.

Il y a lieu de signaler la hausse des prix de tous les aliments du bétail cotés, laquelle s'est accentuée, dans les derniers mois de 1916, sur tous les marchés qui ne sont pas encore soumis à la taxation.

COURS DES CHANGES À LONDRES À LA FIN DE CHAQUE MOIS  
 (Valeur de la livre sterling relativement aux diverses monnaies nationales).

Cours.	Argentine (à trois mois).		États-Unis (cable).		France (chèque).		Italie (à vue).		Pay-Bas (chèque).		Scandinavie (Christiania à vue).	
	Pesos or	Coefficient	Dollars	Coefficient	Francs	Coefficient	Lires	Coefficient	Florins	Coefficient	Kroner	Coefficient
<i>Valeur de la livre sterling au pair</i>	5,04		4,86 <sup>2</sup> / <sub>3</sub>		25,225		25,225		12,107		18,159	
Fin janvier 1916.....	4,90	1,02857	4,76 <sup>13</sup> / <sub>16</sub>	1,02067	28,00	0,90089	31,975	0,78890	11,10	1,09072	17,50	1,03766
<i>id.</i> février.....	4,87	1,03491	4,76 <sup>7</sup> / <sub>8</sub>	1,02054	27,99	0,90121	32,10	0,78583	11,17	1,08389	16,95	1,07133
<i>id.</i> mars.....	4,85	1,03918	4,77	1,02027	28,48	0,88571	31,50	0,80079	11,165	1,08437	16,45	1,10389
<i>id.</i> avril.....	4,88	1,03279	4,76 <sup>15</sup> / <sub>16</sub>	1,02041	28,285	0,89182	30,45	0,82841	11,355	1,06623	15,65	1,16032
<i>id.</i> mai.....	4,89	1,03067	4,76 <sup>7</sup> / <sub>16</sub>	1,02148	28,215	0,89403	30,225	0,83457	11,50	1,05278	15,95	1,13850
<i>id.</i> juin.....	4,90	1,02857	4,76 <sup>3</sup> / <sub>8</sub>	1,02161	28,1375	0,89649	30,35	0,83114	11,475	1,05508	16,30	1,11405
<i>id.</i> juillet.....	4,95	1,01818	4,76 <sup>1</sup> / <sub>2</sub>	1,02134	28,13	0,89673	30,85	0,81767	11,51	1,05187	16,50	1,10055
<i>id.</i> août.....	4,87	1,03491	4,76 <sup>7</sup> / <sub>16</sub>	1,02148	28,115	0,89721	30,90	0,81634	11,545	1,04868	16,84	1,07833
<i>id.</i> septembre.....	4,87	1,03491	4,76 <sup>3</sup> / <sub>8</sub>	1,02161	28,775	0,87663	30,80	0,81899	11,67	1,03745	17,155	1,05853
<i>id.</i> octobre.....	4,86	1,03704	4,76 <sup>3</sup> / <sub>8</sub>	1,02161	27,79	0,90770	31,325	0,80527	11,625	1,04146	17,145	1,05914
<i>id.</i> novembre.....	4,71	1,07006	4,76 <sup>3</sup> / <sub>8</sub>	1,02161	27,79	0,90770	31,495	0,80092	11,665	1,03789	17,275	1,05117
<i>id.</i> décembre.....	4,71	1,07006	4,76 <sup>3</sup> / <sub>8</sub>	1,02161	27,80	0,90737	32,66	0,77235	11,68	1,03656	17,04	1,06567



## Résidus de la meunerie.

COURS DU SON DE BLÉ (disponible, par 100 kg.).

Cours.	Buenos Aires (cons. intér.).	Gênes.	Londres.	Malmö.	Minneapolis (en sacs).	Paris.
	francs-or	francs-or	francs-or	francs-or	francs-or	francs-or
Fin janvier 1916.....	3,40-3,74	15,78	22,09-22,33	26,66-27,38	11,37-11,66	16,67-16,89
<i>id.</i> février <i>id.</i> .....	3,19-3,42	15,72	22,33-22,58	27,53-28,27	11,08-12,24	16,22-16,67
<i>id.</i> mars <i>id.</i> .....	3,20-3,43	.....	19,85-20,10	29,13-29,90	10,64-11,07	15,72-15,94
<i>id.</i> avril <i>id.</i> .....	4,55-5,01	.....	19,73-19,98	31,43-32,23	10,64-11,08	16,72-16,94
<i>id.</i> mai <i>id.</i> .....	4,76-5,10	.....	17,37-17,62	30,04-30,83	11,09-11,67	12,96-13,63
<i>id.</i> juin <i>id.</i> .....	4,53-5,66	.....	13,65-14,27	29,40-30,17	9,92-10,50	14,57-14,79
<i>id.</i> juillet <i>id.</i> .....	5,04-6,28	.....	14,89-15,51	26,75-27,51	10,21-10,50	14,80
<i>id.</i> août <i>id.</i> .....	6,84-7,98	.....	17,37-17,99	26,21-26,96	12,25-12,84	16,15
<i>id.</i> septembre <i>id.</i> .....	7,87-9,58	.....	20,47-21,09	25,73-26,46	11,96-12,55	.....
<i>id.</i> octobre <i>id.</i> .....	12,55-13,69	.....	24,82-25,06	25,74-26,48	15,47-15,76	.....
<i>id.</i> novembre <i>id.</i> .....	15,31-16,49	.....	32,26-33,50	26,28-27,01	16,05-16,34	.....
<i>id.</i> décembre <i>id.</i> .....	11,79-12,26	.....	35,98-36,23	26,64-27,38	15,17-15,47	.....

# Résidus de l'huilerie.

COURS DES TOURTEAUX DE LIN (disponible, par 100 kg.).

Cours.	Copenhague.	Gênes.	La Haye.	Londres.	Marselles.	New-York.
	francs-or	francs-or	francs-or	francs-or	francs-or	francs-or
Fin janvier 1916 .....	40,71-41,07	20,91-21,30	34,31-34,99	32,88-33,50	28,83	21,87-22,74
<i>id.</i> février .....	40,55-42,04	20,82-21,22	35,00-35,45	31,64-32,26	28,61	20,40-20,99
<i>id.</i> mars .....	41,40-41,78	21,22-21,62	.....	29,78-30,40	28,12	17,49-18,65
<i>id.</i> avril .....	43,92-44,32	21,95-22,37	.....	29,47-29,78	28,09-28,98	14,57
<i>id.</i> mai .....	42,30-42,69	22,12-22,53	.....	31,95-32,26	28,16-29,06	15,17-15,76
<i>id.</i> juin .....	41,39-41,78	22,03-22,44	.....	31,02-31,64	28,24-29,14	18,97
<i>id.</i> juillet .....	41,27-41,65	23,30-23,71	.....	31,95-32,26	29,37-29,59	18,96
<i>id.</i> août .....	40,44-41,19	23,27-23,67	.....	33,50-34,12	30,28	21,01
<i>id.</i> septembre .....	40,43-41,17	23,75-24,57	.....	35,36-35,98	30,68	22,47
<i>id.</i> octobre .....	43,03-43,40	25,77-25,97	.....	37,22-37,84	33,13	23,93-24,22
<i>id.</i> novembre .....	48,18-48,91	28,83-30,43	.....	40,95-42,19	35,49	25,10-25,68
<i>id.</i> décembre .....	48,10-48,84	29,35	.....	47,15-48,39	42,65	26,85

## COURS DES TOURTEAUX DE GRAINES DE COTON (disponible, par 100 kg).

Cours.		Copenhague (Texas).	Londres (anglais).	New-York (Mills Texas = Galveston).
		francs-or	francs-or	francs-or
Fin janvier	1916	36,75-36,97	25,75-26,06	15,16
<i>id.</i>	<i>février id.</i>	37,20 37,57	24,51-24,82	14,63
<i>id.</i>	<i>mars id.</i>	37,95-38,33	23,89-24,20	.....
<i>id.</i>	<i>avril id.</i>	42,30-42,71	23,58-24,20	.....
<i>id.</i>	<i>mai id.</i>	41,51-41,90	25,75-26,06	.....
<i>d.</i>	<i>juin id.</i>	40,62-40,77	24,51-24,82	.....
<i>id.</i>	<i>juillet id.</i>	40,51-40,89	24,51-24,82	.....
<i>id.</i>	<i>août id.</i>	41,04-41,19	24,20-24,51	.....
<i>id.</i>	<i>septembre id.</i>	41,31-41,68	25,75-26,06	21,01
<i>id.</i>	<i>octobre id.</i>	45,24-45,97	28,54-29,16	23,34
<i>id.</i>	<i>novembre id.</i>	47,45-48,03	34,74	24,51
<i>id.</i>	<i>décembre id.</i>	47,36-48,10	40,02-40,33	23,93

## COURS DES TOURTEAUX D'ARACHIDES (disponible, par 100 kg).

Cours.		Gênes.	Londres (Coromandel).	Marseille (Rufisque).
		francs-or	francs-or	francs-or
Fin janvier	1916	16,57-16,96	29,16-29,78	17,57-19,82
<i>id.</i>	<i>février id.</i>	16,50-16,90	27,92	18,47
<i>id.</i>	<i>mars id.</i>	16,82-17,22	26,68-27,30	15,06-17,27
<i>id.</i>	<i>avril id.</i>	17,40-17,81	27,30	15,16-21,40
<i>id.</i>	<i>mai id.</i>	17,53-17,94	27,30	15,20-21,46
<i>id.</i>	<i>juin id.</i>	17,45-17,87	27,30	16,59-21,07
<i>id.</i>	<i>juillet id.</i>	18,40-18,81	28,54	16,59-21,52
<i>id.</i>	<i>août id.</i>	18,37-18,78	.....	24,22-25,12
<i>id.</i>	<i>septembre id.</i>	18,02-18,43	.....	23,67-24,98
<i>id.</i>	<i>octobre id.</i>	19,73-20,13	.....	21,78-26,32
<i>id.</i>	<i>novembre id.</i>	22,43	.....	25,42-27,23
<i>id.</i>	<i>décembre id.</i>	21,63	.....	27,22-29,04



## COURS DE TOURTEAUX DIVERS (disponible, par 100 kg.).

Cours.	Sésame.		Soja.		Colza.	Palmiste.	Tournesol.
	Gènes.	Marseille.	Copenhague.	La Haye.			
	francs-or	francs-or	francs-or	francs-or			
Fin janvier 1916 .....	16,17-16,57	18,47-18,92	36,03	35,79	33,51-33,65	23,89-24,51	.....
<i>id.</i> février .....	16,11-16,50	18,02-18,47	36,90-37,20	35,56	41,29-34,22	22,64-22,95	.....
<i>id.</i> mars .....	16,42-16,82	15,50-15,94	38,18-38,33	35,58	34,11-34,50	20,78-21,40	.....
<i>id.</i> avril .....	16,98-17,40	15,16-16,05	41,90-42,30	36,09	36,66-37,07	17,99-18,61	.....
<i>id.</i> mai .....	17,11-17,53	15,20	41,11-41,51	37,83	35,58-35,97	19,23-19,85	.....
<i>id.</i> juin .....	17,04-17,45	15,91-16,14	40,77-41,00	.....	34,43-34,81	19,23-20,16	.....
<i>id.</i> juillet .....	17,99-18,40	16,59-17,04	40,35-40,74	.....	33,63-34,01	19,85-20,47	.....
<i>id.</i> août .....	17,96-18,37	20,64	40,21-40,44	.....	33,32-33,70	22,33-22,64	.....
<i>id.</i> septembre .....	18,02-18,43	21,48-21,92	40,43-40,80	.....	33,08-33,45	22,64-23,58	.....
<i>id.</i> octobre .....	19,33-19,73	21,78-22,69	43,03-43,76	.....	43,03-43,40	27,30-27,98	.....
<i>id.</i> novembre .....	20,82	21,78-22,69	46,35-46,72	.....	39,05-39,42	32,57-33,19	.....
<i>id.</i> décembre .....	20,85	24,05	47,36-47,73	.....	.....	37,53-38,15	26,11

## COURS DES TOURTEAUX DE COPRAH (disponible, par 100 kg.).

Cours.	Gênes.	La Haye.	Londres.	Marseille (½ Cochin).
	francs-or	francs-or	francs-or	francs-or
Fin janvier 1916 .....	17,36-17,75	26,81	26,37-26,68	.....
id. février id. ....	17,29-17,68	27,55	26,06-26,68	24,78
id. mars id. ....	17,62-18,02	26,88-27,11	24,82-25,44	24,80
id. avril id. ....	18,23-18,64	28,88	24,82-25,44	25,86
id. mai id. ....	18,36-18,78	29,17	25,44-26,06	24,14
id. juin id. ....	18,29-18,70	36,27	24,82-25,44	24,21
id. juillet id. ....	17,99-18,40	39,44	25,44-26,06	24,88
id. août id. ....	17,96-18,37	38,23	26,06-27,30	30,06
id. septembre id. ....	18,43-18,84	.....	.....	30,24-30,68
id. octobre id. ....	20,94-21,34	41,22-42,31	.....	31,77
id. novembre id. ....	.....	.....	35,98-37,22	32,68
id. décembre id. ....	23,17	.....	40,47-40,33	.....

## Aliments divers.

## COURS DES RÉSIDUS DIVERS, ETC. (disponible, par 100 kg.).

Cours.	Brizures de riz — Marseille.	Caroubes — Marseille.	Drèches de brasserie desséchées — Londres.	Tourteaux de maïs — New-York.
	francs-or	francs-or	francs-or	francs-or
Fin janvier 1916 .....	37,84	.....	21,71	16,62
id. février id. ....	41,46	22,53-27,04	21,71	16,62
id. mars id. ....	44,29	21,70-23,03	21,71	16,61
id. avril id. ....	44,59	23,19-24,08	21,09	16,61
id. mai id. ....	44,70	26,82	21,09	16,63
id. juin id. ....	44,82	27,79	20,47	16,63
id. juillet id. ....	44,84	27,80	19,85	16,63
id. août id. ....	43,96	26,92	21,09	16,63
id. septembre id. ....	36,82-42,95	20,16	21,09	16,63
id. octobre id. ....	38,12-45,38	19,52-19,97	24,20	16,63
id. novembre id. ....	38,12-45,38	19,97-21,78	31,02	22,76-23,34
id. décembre id. ....	54,44	20,87	34,74	21,59-23,93

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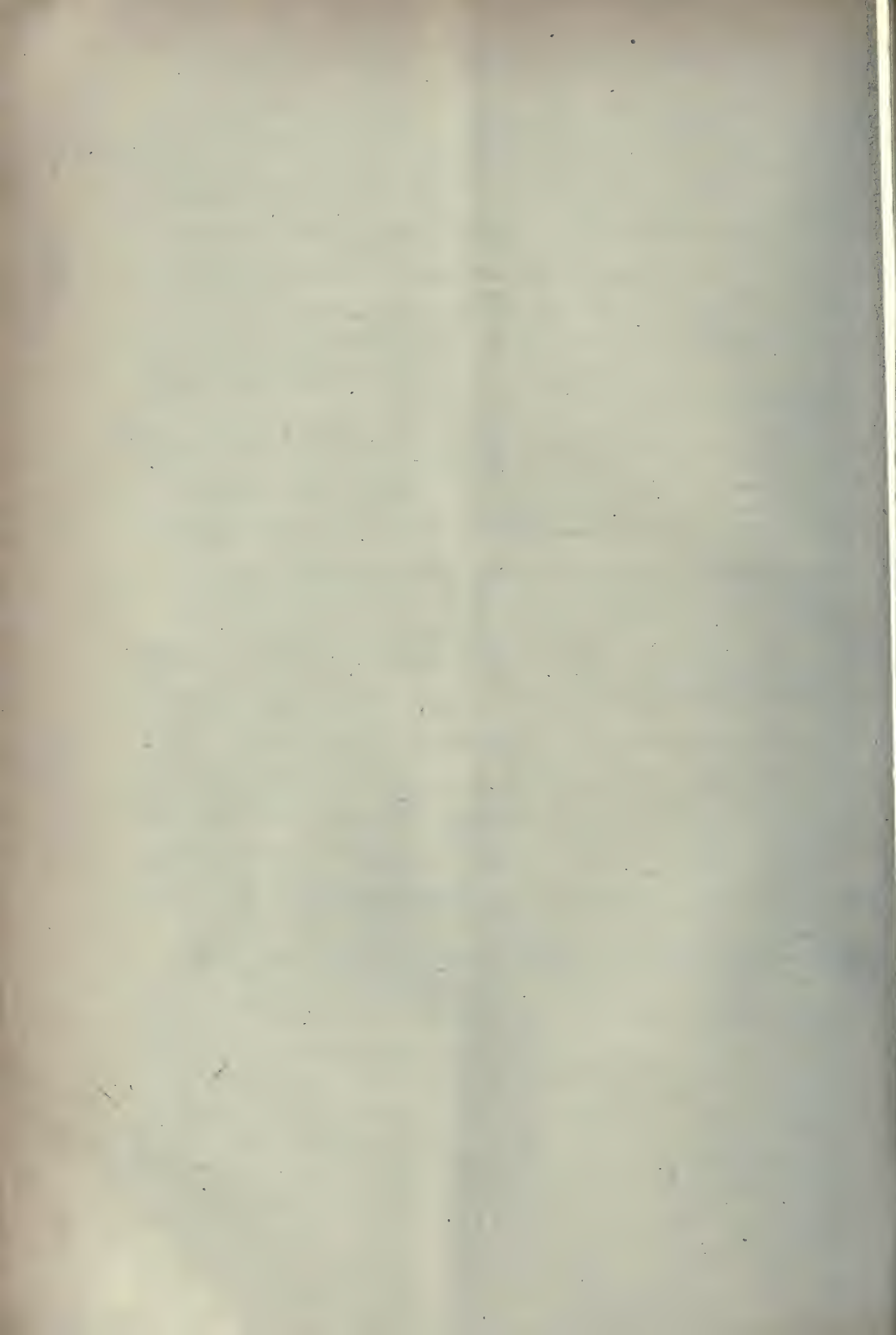


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DEUXIÈME PARTIE  
ARTICLES ANALYSÉS

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RENSEIGNEMENTS AGRICOLES

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RENSEIGNEMENTS GÉNÉRAUX

303 — **Première école de culture mécanique fondée en Allemagne.** — ECKMANN E., dans *Illustrierte Landwirtschaftliche Presse*, 37<sup>ème</sup> Année, N° 10, pp. 54-58. Berlin, 3 Février 1917.

ENSEIGNEMENT  
AGRICOLE

A l'École d'agriculture de Roitz (Nieder Lausitz, Allemagne) a été adjoint, il y a quelque temps, un Institut pour l'enseignement de la motoculture aux agriculteurs qui est le premier créé en Allemagne, avec l'aide du Ministère de l'Agriculture et les subventions de la Chambre d'agriculture de cette région.

L'enseignement lui-même est en partie théorique, en partie pratique. L'enseignement théorique dispose d'un important matériel didactique représentant aux élèves les phénomènes physiques et chimiques qui s'accomplissent dans le moteur. On fait aussi défiler devant leurs yeux, à l'aide de tableaux, les différents systèmes de charrues et on leur en explique les particularités. L'enseignement comporte aussi quelques heures d'agronomie et d'arpentage. De plus, on profite de chaque occasion qui se présente pendant l'enseignement pratique du labour pour donner des explications théoriques, afin que les élèves apprennent à connaître exactement l'action et le but des divers organes de la machine. La direction de l'École part du principe qu'il ne suffit nullement d'enseigner à l'élève à se servir d'une façon purement mécanique d'une motocharrue quelconque, mais que l'élève doit acquérir, au sujet du travail du sol et de la machine, des connaissances pratiques générales lui permettant de comprendre la raison d'être de certaines exigences et le principe de certains dispositifs. On développe ainsi au plus haut point les qualités d'indépendance de l'élève.

L'enseignement pratique porte en premier lieu sur la mise en marche et la direction des divers systèmes (rigides et non rigides) sur champ et sur route, c. à. d. sans labourer. On passe ensuite au labour, même dans les conditions des plus diverses. Grâce à la diversité de ses terrains, le domaine

de l'école de Roitz présente à cet égard les conditions les plus favorables. Dans les exercices pratiques, on attache une importance toute spéciale au développement des connaissances agricoles de l'élève, afin qu'il apprenne à choisir en chaque cas les combinaisons d'instruments aratoires opportunes. Il doit aussi être en mesure de reconnaître avec certitude et rapidité les causes d'accidents survenant aux appareils, et de procéder lui-même autant que possible sur le champ même aux réparations nécessaires. L'enseignement pratique du montage doit être développé à un tel point que le conducteur de la charrue soit ensuite capable de démonter de lui-même un moteur et de le remonter.

Les élèves sont logés dans un bâtiment *ad hoc*. Ils sont placés sous la surveillance d'un « Pflugmeister » (maître de labourage), auquel incombe la direction des travaux pratiques. Les élèves ne paient que leur entretien (actuellement 2 *mark* par jour). Ils peuvent en outre se procurer à leurs frais, dans une cantine située dans le même bâtiment, des aliments ou des boissons.

Un bureau de placement pour conducteurs de charrues automobiles et pour monteurs, rattaché à l'établissement, procure gratuitement des places aux élèves, et moyennant une modeste taxe aux autres solliciteurs.

A l'établissement est aussi annexé un bureau chargé de renseigner tous les intéressés, contre paiement d'une faible taxe, sur toutes les questions relatives à la motoculture.

## PRODUCTION VÉGÉTALE

MÉTÉOROLOGIE  
AGRICOLE.

304 - **Le régime des pluies et des cours d'eau influencé par les forêts, dans l'Inde britannique.** — HILL M., dans *Forest Bulletin* N° 33, pp. 1-41 + 2 cartes concernant la répartition des pluies et des forêts. Calcutta, 1916.

Depuis plus de 50 ans, des lois spéciales ont été promulguées aux Indes pour protéger les bassins de montagne en constituant des forêts réservées (« reserved forests ») et des forêts protégées (« protected forests »), qui couvrent actuellement une superficie respective de 96 867 et de 8 492 *square miles* (250 885 et 21 994 km<sup>2</sup>). Le Rapport analysé expose les résultats d'une enquête organisée par le Gouvernement de l'Inde britannique pour étudier la nature et le caractère des relations éventuelles entre l'étendue des superficies forestières d'une part, le régime des pluies et des cours d'eau d'autre part.

L'examen des matériaux abondants recueillis dans toutes les provinces montre que les mesures de protection introduites au cours des dernières périodes décennales et appliquées avec beaucoup d'opportunité, ont nettement empêché le déboisement dans les zones où les effets de la dénudation du sol avaient commencé à se faire sentir de la façon la plus accentuée. Ces mesures sont en outre venues au bon moment. Dans la première moitié du 19<sup>ème</sup> siècle, la destruction des forêts s'effectuait librement, et parallèlement au développement de l'agriculture et à l'apparition de nouvelles agglomérations humaines : autour de chaque village, la hache de l'indigène ou du



spéculateur faisait dans les bois des éclaircies de plus en plus vastes. Les conséquences de cette façon de faire ne manquèrent pas de se répercuter sur le régime des fleuves : de plus en plus rapides et impétueux pendant les crues, pauvres en eau ou même complètement desséchés pendant l'étiage. C'est ce qui s'est passé dans la province de Bombay, dans le gouvernement de Madras (régions des collines de Parlakimedi Maliahs et du Vizagapatam), au Bengale, spécialement dans le « Chota Nagpur », l'Orissa et les « Feudatory States » (états feudataires).

Les Provinces-Unies, et tout particulièrement les grands et beaux bois de chênes de l'état de Tehri-Gahrwal souffrirent considérablement du déboisement, ainsi que les districts de Siwaliks, Salt Range, Kangra et Pabbi dans le Punjab. Aux environs de Simla, les bois de pins et de chênes séculaires furent abattus pour faire place à la culture des pommes de terre, et il en a été de même sur le « Myelat Plateau », dans les « Southern Shan States » (états méridionaux du San), près de la frontière chinoise.

L'enquête faite par le Gouvernement de l'Inde britannique porte essentiellement sur 3 points : 1) le régime des pluies ; 2) les oscillations du niveau des eaux souterraines ; 3) le régime des cours d'eau ; le tout en rapport avec les améliorations dues à l'application des lois protectrices.

1) *Régime des pluies* : au cours des 50 dernières années on n'a pas constaté, dans le régime des pluies, des changements permanents en rapport direct avec les courants des moussons, conditionnés et réglés par des phénomènes qui se produisent dans des zones fort éloignées de l'Inde, et qui ne peuvent donc être influencés par des reboisements ou des déboisements locaux. Les matériaux recueillis permettent toutefois de déduire que les forêts peuvent, dans une mesure restreinte, ne dépassant pas 5 %, élever le total des précipitations en favorisant la condensation de la vapeur d'eau.

2) *Le niveau des eaux souterraines* ne s'est nullement modifié dans les 50 dernières années ; il est en rapport direct et immédiat avec la marche des précipitations.

3) *Le régime des cours d'eau* est la partie la plus importante et la plus significative de l'enquête. En voici, en résumé, les points principaux : Dans le Bengale oriental et dans l'Assam, on a déboisé quelque peu même pendant les dernières périodes ; toutefois la reprise et le développement rapide de la végétation dans les zones incultes ont en grande partie neutralisé les effets du déboisement partiel.

On a constaté dans le régime des cours d'eau une accentuation de leur caractère torrentiel dans la région des collines de Siwalik (« United Provinces »), sans que l'on puisse toutefois attribuer ce fait à la destruction des forêts, lesquelles n'ont été soumises à aucune coupe depuis 30 ans.

Au Bengale les plaines d'alluvion d'Orissa ont été endommagées à plusieurs reprises par des inondations brusques et violentes, dont on ne se souvenait pas de mémoire d'homme ; ces faits ont pour cause la destruction des massifs boisés dans le bassin collecteur des rivières qui coulent vers les plaines d'Orissa, à laquelle il n'a pas été possible de remédier jusqu'ici.

Quant aux Provinces Centrales (« Central Provinces »), les forêts qui recouvrent les bassins collecteurs des principaux cours d'eau n'ont pas eu

à souffrir ; dans certaines localités, elles ont même été notablement améliorées. Il en est de même dans la Présidence de Madras. En rapport avec ces faits, le régime des cours d'eau est régulier et modéré. Au Punjab, les dégâts produits par des éboulements, des avalanches et des inondations dans le « Pabbi Range », dans l'« Hoshiarpur Chos », les « Siwaliks », le « Salt Range » et les derniers contreforts de l'Himalaya, sont dus sans aucun doute au débilement.

On peut donc dire, d'une façon générale, que dans la majeure partie des provinces on n'a pas enregistré de graves dégâts imputables au régime irrégulier des cours d'eau. Le Punjab, le Bengale et l'Assam présentent toutefois quelques graves exceptions : dans ces cas c'est assurément la destruction des forêts qui a profondément modifié le régime des cours d'eau en accentuant leur caractère torrentiel. On peut donc conclure que les dispositions prises par le Gouvernement de l'Inde britannique ont parfaitement répondu, dans les 50 dernières années, aux nécessités climatologiques et hydrographiques du pays, à tel point que l'on n'a constaté aucun dommage sérieux du fait d'un changement dans le régime des pluies et des cours d'eau. Cela est dû en grande partie à la création de forêts protégées et réservées dans la zone des bassins collecteurs des grands cours d'eau, et si, comme on l'a dit plus haut, des inondations et des crues se sont produites dans certaines régions, c'est parce que le régime de protection forestière n'a pas encore pu y être établi régulièrement. En effet, si en moyenne les forêts domaniales occupent 22,1 % de la superficie totale des provinces de l'Inde, leur répartition est bien loin d'être uniforme : de 59 % en Birmanie, la proportion s'abaisse à 9 % dans le Punjab, à 4 % dans les Provinces-Unies, et à 3 % dans le Bihar et l'Orissa.

305 - Influence des facteurs météorologiques, d'une année à l'autre, sur le degré glucométrique des moûts d'une même vigne. — Voir N° 366 de ce *Bulletin*.

PÉDOLOGIE.

306 - Assimilabilité de la potasse chez des sols à orthose chaulés et plâtrés ; expériences en Californie, États-Unis. — BRIGGS LYMAN J. et BREAZEAL J. F., dans *Journal of Agricultural Research*, Vol. VIII, N° 1, pp. 21-28. Washington, 2 Janvier 1917.

Il est dit dans les traités d'agriculture que le chaulage libère de la potasse des minéraux du sol. Ce fait a une importance spéciale pour la culture industrielle des agrumes dans le sud de la Californie, où les engrais artificiels du commerce sont fort employés et où l'on pratique parfois aussi de forts chaulages et plâtrages.

On prélève près de Riverside, Californie, des échantillons de pegmatite et d'orthose représentant respectivement les types de roche et de minéral potassiques d'où bien des sols à agrumes semblent être dérivés. Ces échantillons, finement moulus, furent agités pendant plusieurs jours avec des solutions aqueuses d'hydrate et de sulfate de calcium à titres échelonnés. Les solutions d'hydrate de calcium ne modifièrent la solubilité de la potasse ni chez la pegmatite, ni chez l'orthose (voir Tableau I). Les solutions de gypse diminuèrent la solubilité de la potasse chez l'orthose, la quantité de potasse décroissant progressivement à mesure que le titre en sulfate de calcium augmentait (voir Tableau II).

On fit des essais semblables avec un sol vierge de type granitique provenant de la Station d'essais près de Riverside : Il n'y eut pas de différences appréciables entre la solubilité respective de la potasse dans : l'eau distillée — la solution de chaux — la solution de gypse.

L'addition de sulfate de calcium à un sol à agrumes de la région d'Oatman (à environ 11 km de Riverside) précédemment en culture pendant quelque temps, plus granuleux et moins altéré que le sol vierge, diminua la solubilité de la potasse.

La teneur en potasse de plantules de blé était à peu près la même lorsqu'elles croissaient dans de l'eau contenant de la poudre fine d'orthose ou bien dans une solution saturée de gypse contenant la même quantité d'orthose.

Des expériences similaires, dans lesquelles on employa un sol à agrumes au lieu d'orthose, accusèrent une diminution dans l'absorption de potasse par les plantules de blé en présence du sulfate de calcium (voir Tableau III).

En résumé, ces expériences montrent que l'assimilabilité de la potasse pour les plantes dans des terres dérivant de roches à orthose n'a pas été augmentée par l'addition de chaux ou de gypse. Dans certains cas, il y a eu une diminution marquée de la solubilité de la potasse en présence du gypse. Ces conclusions s'appuient à la fois sur les résultats des analyses des solutions et sur l'évaluation de la teneur en potasse des plantules de blé ayant poussé dans ces solutions.

TABLEAU I. — *Effet de solutions d'hydrate de calcium sur la solubilité de la potasse chez : la pegmatite — l'orthose — un sol provenant de la Station d'essais sur agrumes de Riverside.*

Solution N°	Pegmatite		Orthose		Sol de Riverside	
	Oxyde de calcium dans 100 cm <sup>3</sup> de solution, en grammes	Oxyde de potassium dissous, en millionièmes	Oxyde de calcium dans 100 cm <sup>3</sup> de solution, en grammes	Oxyde de potassium dissous, en millionièmes	Oxyde de calcium dans 100 cm <sup>3</sup> de solution, en grammes	Oxyde de potassium dissous, en millionièmes
1	—	3,1	—	10,8	—	26,4
2	0,0 123	3,1	0,0 103	8,6	0,0 103	26,4
3	0,0 246	2,5	0,0 207	12,0	0,0 207	28,8
4	0,6 369	3,1	0,0 414	8,2	0,0 414	28,8
5	0,0 492	3,0	0,0 621	9,1	0,0 621	24,0
6	0,0 738	3,0	0,0 828	12,6	0,0 828	27,6
7	0,0 984	3,1	0,1 035	12,1	0,1 035	25,2
8	0,1 230 (a)	2,8	0,1 242 (a)	0,6	0,1 242 (a)	27,6

(a) Phase solide présente.



TABLEAU II. — *Effet de solutions de sulfate de calcium sur la solubilité de la potasse chez : la pegmatite — l'orthose — un sol de Riverside — un sol d'Oatman.*

Solution N°	Pegmatite		Orthose		Sol de Riverside		Sol d'Oatman	
	Sulfate de calcium dans 100 cm <sup>3</sup> de solution, en grammes	Oxyde de potassium dissous, en millioniè- mes	Sulfate de calcium dans 100 cm <sup>3</sup> de solution, en grammes	Oxyde de potassium dissous, en millioniè- mes	Sulfate de calcium dans 100 cm <sup>3</sup> de solution, en grammes	Oxyde de potassium dissous, en millioniè- mes	Sulfate de calcium dans 100 cm <sup>3</sup> de solution, en grammes	Oxyde de potassium dissous, en millioniè- mes
1	—	2,7	—	6,0	—	24	—	8,6
2	0,0 221	2,1	0,018	4,5	0,017	24	0,017	8,6
3	0,0 446	2,1	0,035	3,6	0,034	26	0,034	8,0
4	0,0 668	2,0	0,070	3,6	0,068	29	0,068	4,2
5	0,0 864	3,2	0,105	1,2	0,102	26	0,102	2,2
6	0,1 330	2,2	0,140	0,8	0,136	26	0,136	2,2
7	0,1 660	2,1	0,175	1,3	0,170	29	0,170	2,4
8	0,2 100 (a)	2,8	0,210 (a)	0,5	0,210 (a)	26	0,210 (a)	4,2

(a) Phase solide présente.

TABLEAU III. — *Potasse absorbée par des plantules de blé au sein de solutions d'orthose et de sols traitées par le gypse.*

Série N°	Traitement	Pourcentages d'oxyde de potassium dans les plantes sèches
1	10 g d'orthose + 2 500 cm <sup>3</sup> d'eau saturée d'acide carbonique. . . . .	1,10 %
1a	<i>Idem</i> , saturé de sulfate de calcium . . . . .	0,95
2	10 g d'orthose + 2 500 cm <sup>3</sup> d'eau carbonique. . . . .	1,84
2a	<i>Idem</i> , saturé de sulfate de calcium . . . . .	1,72
3	40 g d'orthose + 2 400 cm <sup>3</sup> d'eau carbonique + 200 millionièmes de NO <sup>3</sup> + 200 millionièmes de P <sup>2</sup> O <sup>5</sup> . . . . .	2,56
3a	<i>Idem</i> , saturé de sulfate de calcium . . . . .	2,57
4	50 g de sol d'Oatman + 2 500 cm <sup>3</sup> d'eau carbonique . . . . .	1,75
4a	<i>Idem</i> , saturé de sulfate de calcium . . . . .	1,35

307 — **Nature du soufre des terrains marécageux nuisible aux plantes et aux constructions souterraines.** — THORNER WILHELM, dans *Zeitschrift für angewandte Chemie*, 29<sup>ème</sup> Année, N° 47, pp. 233-236. Leipzig, 1916.

D'après les recherches et expériences de l'A., le soufre actif des terrains marécageux qui est dangereux pour la croissance des plantes et pour les constructions souterraines ne s'y trouve pas seulement sous forme de pyrite, mais aussi à l'état libre et peut-être également sous forme organique. Il est de nature tout à fait inoffensive tant qu'il s'y trouve au-dessous du niveau de l'eau souterraine. Mais si ces terrains sont retournés ou défoncés, ou si le niveau de l'eau souterraine s'y abaisse, il se produit, par effet de l'humidité et de l'oxygène de l'air, une oxydation du soufre. Celle-ci procède d'une façon assez énergique chez la pyrite en formant du sulfate de fer et de l'acide sulfurique. Chez le soufre libre elle est moins énergique et forme directement de l'acide sulfurique. Ces produits d'oxydation nui-

sont fortement non seulement aux plantes, mais aussi au mortier de chaux et de ciment des constructions souterraines (surtout de celles en béton). Quant au soufre finement réparti dans du sable ou des fibres de tourbe, etc, une évaporation prolongée de l'eau au contact de l'air l'oxyde peu à peu en acide sulfurique. Cette oxydation est très probablement provoquée par les agents oxydants suivants qui se forment lors de l'évaporation de l'eau : ozone, peroxyde d'hydrogène et acide nitreux. Il se produit des phénomènes analogues dans les terrains marécageux humides contenant du soufre qui sont défoncés et pénétrés par l'air. Sous l'influence du peroxyde d'hydrogène, de l'ozone et de l'oxygène au moment de leur formation, le soufre fin en suspension dans l'eau est oxydé énergiquement en acide sulfurique.

308 - Le canal d'irrigation du "Pusztá Hortobágy", en Hongrie (1). — KVASSAY J., dans *Kösztelek*, Année 26, N° 52, pp. 1869-1870. Budapest, 23 Décembre 1916.

Parmi les travaux hydrauliques les plus importants exécutés par les ingénieurs du Service national de l'hydraulique agricole, il faut compter la construction du canal d'irrigation du « pusztá Hortobágy » (le plus grand des steppes de l'« Alföld » (grande plaine) de Hongrie). Elle a résolu deux questions très importantes dont on s'est occupé depuis plus de 10 ans : la dérivation des eaux de la Tisza à travers le grand « pusztá Hortobágy » et l'amélioration des sols alcalins qui s'y trouvent par l'irrigation.

Le canal d'irrigation provient de la rive gauche de la Tisza, au-dessus de la commune de Tiszakeszi et, après un cours de 18,5 km, il atteint sa destination d'utilisation : terrain de 3 000 arpents cadastraux (1 727 ha), nommé en hongrois « Csunya Föld » (terre vilaine), réservé par la ville de Debreczen aux prairies irriguées d'essais. Le canal est construit de façon à recevoir les eaux directement du fleuve lors des fortes crues (dépassant 4 m) tandis que, en temps normal, l'eau lui est amenée par des pompes.

Au printemps de 1916, la masse d'eau s'écoulait directement dans le canal, et l'on a réussi à immerger 2 bassins de 500 arpents cadastraux (288 ha), dont la construction était achevée à cette date. Lors des fortes crues, le canal peut fournir une dérivation de 4 000 litres d'eau par seconde. Il est traversé par des ponts larges de 4 m dont le tablier est placé assez haut pour permettre à des pontons larges de 3 m de circuler aisément dans le canal. Les pompes, actionnées par 2 moteurs LIETZENMAYER-NICHOLSON de 115 HP chacun, peuvent élever à 3-4 m une masse d'eau de 2 400 à 3 000 litres par seconde.

Sur les 3 000 arpents cadastraux (1 727 ha), les parties les meilleures, comprenant 1 000 arpents cadastraux (576 ha) sont destinées aux irrigations, tandis que 2 000 arpents cadastraux (1 151 ha), divisés en 8 parcelles, serviront pour des bassins. Ceux-ci ne pouvant être mis en culture à cause de la forte alcalinité de leur sol, ils seront lessivés au préalable. En attendant on y a créé des étangs à poissons (2). Ainsi, au printemps de 1916, on a

HYDRAULIQUE ET AMÉLIORATIONS AGRICOLES.

(1) Voir aussi : B. 1913, N° 441.

(2) Voir à ce sujet : B. 1916, N° 330.

(N. d. R.)

(N. d. R.)



empoissonné 2 bassins de 500 *arpents cadastraux* (288 ha), et l'on a obtenu jusqu'ici des résultats très satisfaisants.

Les travaux de construction du canal, commencés en 1913, sont aujourd'hui en grande partie terminés. Pour les travaux du grand canal et pour les champs d'essais on a prévu une dépense de 1 million de *courounes* (1), dont on a dépensé jusqu'ici 650 000 ; le reste doit servir à l'organisation interne. L'Etat alloue une subvention de 500 000 *courounes* pour les travaux d'irrigation. On espère que ceux-ci pourront améliorer et rendre fertile une superficie d'environ 100 000 *arpents cadastraux* (57 550 ha) occupant en partie le grand « *puszta Hortobágy* », en partie les terrains alcalins adjacents. Il y a en outre, sur les bords du Danube et de la Tisza, des terrains alcalins analogues couvrant plus de 1 million d'*arpents cadastraux*. Cela montre la grande importance du canal en question, qui permettra de transformer ces immenses superficies en terrain cultivable.

309 - Les « *navazos* » et leur emploi pour la fixation des dunes dans la province de Cadix, Espagne. — DE CASTRO MANUEL M. FERNANDEZ, dans *Revista de Montes*, XLII<sup>e</sup>me Année, N° 961, pp. 77-85, 3 fig. Madrid, 1<sup>er</sup> Février 1917.

Les « *navazos* » constituent une méthode caractéristique de mise en valeur des terres ensablées. L'A. décrit ceux de l'embouchure du Guadalete, sur un terrain pliocène qui, avec le temps, s'est trouvé recouvert d'une couche sableuse et transformé en dune. On a alors rendu le terrain à la culture en le transformant en « *navazos* ». Le « *navazo* » peut être établi partout où un sol très perméable et peu profond est superposé à un sous-sol peu perméable, de telle sorte qu'entre les deux il se forme une couche d'eau phréatique qui, remontant par capillarité, tient lieu d'irrigation. Dans la localité en question, ils sont constitués respectivement par la couche de sable et par le terrain pliocène.

Le « *navazo* » s'installe de la manière suivante : sur le sable, qui doit atteindre une épaisseur maximum de 2 à 3 m, on trace un rectangle de la superficie à mettre en culture, et l'on en extrait le sable jusqu'à 50-80 cm de profondeur, au-dessus du niveau de l'eau phréatique en été. En un point convenable de ce rectangle, on creuse à une profondeur de 1 à 1,5 m de plus, et l'on forme ainsi un puits permanent, appelé dans le pays « *toyo* ». Quand la montée de l'eau phréatique, produite par la capillarité, n'est pas suffisante pour les besoins de la culture, on tire l'eau du « *toyo* » avec des seaux d'une forme spéciale, et on l'emploie pour irriguer le potager. Sur la partie la plus élevée du sable, à la limite du point creusé, on construit la maison du jardinier.

Les terrains de l'embouchure du Guadalete avaient été transformés en une série de « *navazos* » placés d'un à côté de l'autre. L'ensablement continuant à se produire, il arriva un moment où il ne fut plus possible de les maintenir ; les « *navazos* » abandonnés se transformèrent rapidement en dunes stériles, et alors le problème du boisement vint à se poser.

Le boisement fut exécuté sous la direction de l'ingénieur ANGEL



FERNANDEZ de CASTRO de 1905 à 1913, au moyen de pins pignons (*Pinus Pinea* L.).

Dans les parties de « navazo » non encore envahies par le sable, c'est-à-dire dans le terrain bien fumé par les anciennes cultures, où l'eau se trouvait à proximité de racines, les arbres ont poussé avec une grande vigueur, au point que quelques pins de 7 ans ont jusqu'à 5,2 m de hauteur, et que l'on a même des accroissements annuels de 1,57 m. Sur les levées de terrain de séparation d'un « navazo » à l'autre, l'accroissement est plus lent ; toutefois il est encore plus rapide que dans les sables envahissants, où l'accroissement est très lent.

Ces travaux de boisement ont fourni à l'A. l'occasion de faire diverses expériences.

Un groupe d'arbres plantés serrés a été abandonné complètement à sa croissance naturelle. Il s'y produit ceci : les verticilles inférieurs du *Pinus Pinea* sont complètement morts, c. à. d. qu'il s'y est manifesté une sorte d'élagage naturel. Aux endroits où l'on a adopté la densité de plantation normale, cet élagage naturel ne s'est pas produit, et moins encore là où la plantation était clairsemée. Dans ces derniers cas, il est donc avantageux de pratiquer l'élagage. Aux environs de Cadix et de Séville, les élagages se font très énergiques, et l'on y emploie les petites branches de pin ainsi éliminées pour chauffer les fours à pain.

Les pins fournissent en outre du bois pour la construction de barques fluviales et de barques de pêche, très employées dans la province.

La production des pignons est aussi très abondante.

310 - **Explorations et études des gisements de phosphorites en Russie : résultats de 1914.** — Проф. САМОЙЛОВЪ Я. В. (САМОИЛОВ JA. V. prof.), dans *Отчетъ по геологическому изслѣдованію фосфоритовыхъ залежей* (Rapports sur les explorations et études des gisements de phosphorites), Vol. VII, pp. 1-25 + 1-591, 54 fig. + 8 planches + 17 cartes. Moscou, 1915.

AMENDEMENTS  
ET ENGRAIS

Le Rapport pour 1914 de la Commission d'étude des gisements de phosphorites (de l'Institut Agronomique de Moscou), publié par le prof. SAMOÏLOV, contient 12 travaux détaillés sur les gisements de phosphorites de diverses régions de la Russie, faits par divers auteurs et enrichis de nombreuses figures, planches et cartes. Il est précédé d'une Introduction du prof. SAMOÏLOV (pp. 1-25) exposant les résultats généraux des explorations et études de 1914. En voici les traits essentiels :

En 1914, on a fait des explorations et études dans les provinces de : Samara, Tambov, Koursk, Orel, Kalouga, et dans les régions de Turgaisk et des Monts Ourals, en accomplissant entièrement le programme établi, malgré la guerre. Comme les Rapports précédents (1), celui-ci indique, pour chacune des zones étudiées :

1) La productivité des gisements, exprimée en pouds de 16,38 kg par sajen carré de 4,55 m<sup>2</sup>.

2) La superficie totale des gisements, exprimée en verstes carrées de 1,138 km<sup>2</sup>.

(1) Voir B. 1915, N° 1258.

(N. d. R.)

3) La quantité totale de phosphorites contenue dans les gisements, exprimée en millions de pouds.

4) La quantité totale d'anhydride phosphorique correspondante, exprimée également en millions de pouds.

Suivant la classification proposée par l'A., les phosphorites sont divisées en 3 groupes :

Groupe A :	Phosphorites contenant de 12 à 18 % d'anhydride phosphorique
Groupe B :	» de 18 à 24 % »
Groupe C :	» plus de 24 % »

Chez les phosphorites étudiées en 1914 prédominaient celles du groupe B, qui se trouvaient dans 13 gisements sur 17 étudiés et contenaient le plus fréquemment 20 % d'anhydride phosphorique, les 4 autres gisements se composant de phosphorites du groupe A.

Les zones explorées en 1914 accusaient :

Superficie totale des gisements . . . . .	4 999	kilomètres carrés
Quantité totale de phosphorites . . . . .	17 650	millions de quintaux
Quantité totale d'anhydride phosphorique . . . . .	2 885	millions de quintaux
Productivité moyenne . . . . .	3,5	quintaux par m <sup>2</sup> .

En ajoutant les quantités de phosphorites évaluées dans les gisements en 1914 à celles des années précédentes, on obtient une quantité totale de 51 223 millions de quintaux, qui se répartit comme suit entre les 3 groupes susdits :

	Quantité de phosphorites	
	en millions de quintaux	en %
Groupe A (12 à 18 % P <sup>2</sup> O <sup>5</sup> ) . . . . .	34 894	68,1
Groupe B (18 à 24 % P <sup>2</sup> O <sup>5</sup> ) . . . . .	14 935	29,2
Groupe C (plus de 24 % P <sup>2</sup> O <sup>5</sup> ) . . . . .	1 394	2,7
<b>Totaux</b>	<b>51 223</b>	<b>100,0</b>

Le Rapport se termine par une étude du prof. SAMOÏLOV sur les gisements de phosphorites trouvés sur la rive droite de la rivière Desna (district de Krolevez, province de Tchernigov), lesquels présentent un intérêt scientifique particulier aux points de vue géologique et minéralogique, étant donnés les problèmes difficiles que soulèvent : leur genèse — leur forme — la grande accumulation de nodules phosphatés de types divers — la nature de la masse de cimentation. Il importe de résoudre ces problèmes non seulement au point de vue théorique, mais aussi pour les besoins pratiques, soit en vue de mieux utiliser ces gisements, soit en vue d'en trouver d'autres similaires.

312 — **Espèces croissant dans le Jardin d'acclimatation de Casa Bianca, province de Grosseto, Italie.** — FENZI E. O., dans *Buletino della R. Società Toscana di Oricoltura*, XI, IIème Année, N° 1, pp. 11-13. Florence, 15 Janvier 1917.

Le Jardin d'acclimatation de Casa Bianca, à l'extrémité méridionale du Monte Argentario (province de Grosseto), fut fondé en 1868 par le général VINCENZO RICASOLI. En 1888, il contenait déjà 1 866 espèces de 626 genres différents. Dans la suite, il s'est continuellement enrichi et étendu. Parmi les exemplaires les plus beaux qui y croissent actuellement, l'A. cite, au nombre des Palmiers qui y fructifient régulièrement : *Cocos flexuosa* — *C. Romanzoffiana* — *Livistona australis* — *L. chinensis* — *L. olivaeformis* — *Sabal Blackburnianum* — *S. Palmetto* — *S. mexicanum* (= *umbraculiferum*) ; — parmi ceux qui ne fructifient pas régulièrement : *Phoenix reclinata* — *Ph. canariensis* — *Washingtonia gracilis*, etc. Les palmiers expérimentés y sont au nombre de plus d'une centaine d'espèces et variétés ; environ la moitié produisent des graines chaque année. Parmi les Conifères, il existe un exemplaire colossal de *Pinus Laricio* (= *P. Paroliniana*). *Araucaria Bidwillii* et *Agathis (Dammara) robusta* y fructifient régulièrement. A noter les autres espèces suivantes : *Aberia caffra* (fruits excellents pour conserves) — *Alpinia nutans*, qui y fructifie — *Oreopanax floribundum* (= *Aralia Humboldtiana*) — *Aralia nymphaeefolia* — *Schefflera digitata* (= *Aralia Schefflera*) — *Aesculus californica* — *Chorisia speciosa* (fournit le kapok du Brésil) — *Dais cotinifolia* — *Jacarandia ovalifolia*, qui fructifie chaque année — *Kennedya nigricans* — *Parkinsonia aculeata* — *Persea gratissima* (exemplaire très grand, mais qui n'a jamais fructifié) — *Psidium Cattleianum* (fructification abondante) — *Pittosporum undulatum* — *P. phylliraeoides* — *Schotia speciosa* — *Senecio Barba-Joannis* — *Tecoma Ricasoliana* et d'autres *Tecoma* très nombreux. Les eucalyptus expérimentés y sont au nombre d'une centaine d'espèces ; les acacias, plus de 150 espèces ; les *Agave* une centaine d'espèces ; les *Opuntia*, autant, provenant presque tous du Mexique ; les *Mesembryanthemum*, environ 70 espèces, etc.

313 — **Développement du système radical chez *Cirsium arvense* et *Medicago sativa* par rapport à leur reproduction végétative ; observations faites en Russie.**

— I. Пачоский I. (PACZOSKI J.), Les particularités biologiques de *Cirsium arvense* Scop., dans *Труды Бюро по прикладной ботанике* (Bulletin de Botanique appliquée), IXème Année, N° 1 (86), pp. 1-16. Pétrograd, Janvier 1916. — II. Бергъ O. (BERG F.), Note sur quelques particularités biologiques de la luzerne et de *Cirsium arvense* Scop. *Ibidem*, N° 2 (92), pp. 353-357, Juillet 1916.

I. — En se basant sur : a) l'importance des changements de saison dans la vie des plantes ; b) les pertes de divers organes subies par les plantes dans les saisons défavorables, l'A. répartit les organismes végétaux entre les types biologiques suivants :

- 1) *Plantes toujours vertes* (tous les organes sont pérennes)
- 2) *Arbres et arbustes à feuilles caduques* (tous les organes sont pérennes, sauf les feuilles, qui sont caduques)
- 3) *Sous-arbustes* (sont annuelles, non seulement les feuilles, mais aussi les cimes des tiges)
- 4) *Plantes herbacées pérennes hémicryptophytes* (sont annuelles toutes les parties aériennes)



5) *Plantes herbacées cryptophytes* (sont annuelles, non seulement les parties aériennes, mais aussi les parties souterraines jusqu'à une certaine profondeur)

6) *Plantes annuelles* (y compris les plantes « pérennes » dont il ne subsiste en hiver que les bourgeons, qui remplacent les graines).

Dans cette classification, il y a un passage graduel des plantes pérennes aux plantes annuelles ; les pertes annuelles des plantes augmentent aussi graduellement jusqu'à la perte totale, à l'exclusion seulement des graines ou des bourgeons de régénération.

Des observations faites sous la direction de l'A., à la Station agronomique d'Adjamsk (Zemstvo provinciale de Kherson), à partir de l'été de 1914, il résulte que *Cirsium arvense* Scop. est une plante cryptophyte typique, car elle a 2 types de racines : vertical et horizontal.

La *racine verticale* peut atteindre et même dépasser 6,4 m de profondeur (à la Station d'Adjamsk on a constaté une profondeur maximum de 6,2 mm).

Les *racines horizontales*, qui occupent une profondeur comprise entre 14 et 28 cm (rarement plus bas), s'étendent plus ou moins parallèlement à la surface du sol et peuvent atteindre et même dépasser 2,14 m de longueur. Les bourgeons qui se forment sur ces racines donnent naissance à des rejets aériens, qui deviennent ensuite de nouvelles plantes. Au moyen de ces racines, *C. arvense* peut s'étendre en surface même si la fructification vient à être supprimée, et cela explique ce fait bien connu : dans un champ qu'il a presque complètement infesté, *C. arvense* forme des foyers ou des taches, tandis que les plantes isolées caractérisent le début de l'infestation.

Les observations faites à la Station d'Adjamsk ont démontré que, à l'approche de l'hiver, il n'y pas seulement la partie aérienne de cette plante qui meure, mais aussi la partie supérieure de la racine verticale (ou la partie souterraine de la tige s'il s'agit d'une plante ayant plus de 1 an). Ce dépérissement total de la racine atteint une profondeur de 14 à 26 cm (et parfois même plus), en sorte que les bourgeons de régénération se disposent un peu en dessous de cette profondeur, sur la partie saine de la racine.

Selon l'A., *cette particularité biologique de C. arvense est très importante, et toutes les autres particularités de cette plante ne sont que la conséquence du dépérissement de sa partie souterraine jusqu'à une certaine profondeur.*

Quant à la profondeur atteinte par les bourgeons de régénération, l'A. admet qu'elle dépend de l'état des parties aériennes de la plante au commencement de l'automne. Ainsi, chez les plantes atteignant l'hiver avec les tiges non coupées, les bourgeons se trouvaient à une plus grande profondeur, et il en était de même du dépérissement de la partie supérieure de la racine. Par contre, quand les tiges avaient été coupées rez terre en automne, les bourgeons se trouvaient plus près de la surface, parfois même immédiatement sous la taille.

Se basant sur les observations précitées et sur ce fait observé durant l'hiver 1914-1915 : les plantes de *C. arvense* nées en juillet moururent de froid vers le printemps malgré la douceur de l'hiver, l'A. conclut :

1) Relativement à la formation de nouveaux foyers de *C. arvense*, il est évident que les plantes nées jusqu'à l'automne des graines de l'année

en cours ne peuvent avoir aucune influence, parce qu'elles seront mortes avant le printemps. Ce sont donc seulement les plantes nées au printemps qui peuvent former de nouveaux foyers. Il faut toutefois remarquer que les plantes de *C. arvense* provenant de graines ne se développent rapidement que dans la seconde moitié de l'été, en sorte qu'un travail superficiel du sol fait immédiatement après la moisson peut empêcher complètement la formation de nouveaux foyers de cette plante.

2) Les façons superficielles d'automne réussissent d'autant moins à détruire *C. arvense* qu'elles sont plus tardives et moins profondes, car, dans ces conditions, on ne coupe que les parties de la plante déjà mortes ou en train de mourir, tandis qu'auparavant les substances nutritives sont passées dans les parties plus profondes de la racine, qui restent vivantes. Cette déduction théorique est pleinement confirmée par les observations faites sur *C. arvense* dans des champs de seigle de paysans (travail du sol tardif et peu profond).

3) Il est très probable qu'en coupant *C. arvense* à une profondeur donnée dans le sol durant le printemps, où les premières repousses de la plante s'appêtent à sortir de terre, on peut endommager davantage la plante surtout si l'on opère la coupe en dessous de la partie où se trouvent les bourgeons de régénération. Les expériences faites à ce sujet à la Station d'Adjamsk, à diverses profondeurs (jusqu'à 44 cm), ne sont pas encore terminées, mais on a pu observer que la coupe peu profonde (jusqu'à 27 cm) ne déprime pas beaucoup *C. arvense*, tandis que la coupe plus profonde produit un effet notable, sans qu'il y ait toutefois utilité à dépasser 35 cm, la coupe faite à cette profondeur ayant donné d'aussi bons résultats que celle atteignant 44 cm. Il est évident que la coupe doit enlever la partie de la plante où se trouve la masse principale de bourgeons de régénération, c. à. d. celle qui est comprise entre 17 et 35 cm. Une seule coupe, même à 44 cm de profondeur, ne suffit pas à extirper complètement *C. arvense*, mais elle semble toutefois capable d'assurer la récolte des céréales de printemps. Cette question fera l'objet d'expériences spéciales.

L'A. passe enfin en revue les procédés actuels de lutte contre *C. arvense*, qu'il trouve trop peu précis, et il relève la nécessité d'entreprendre une série d'expériences concernant le travail du sol à diverses profondeurs et à diverses époques. C'est seulement à cette condition que l'on pourra acquérir des notions permettant de créer un système de lutte efficace avec un minimum de frais.

II. — L'A. attire l'attention sur des particularités physiologiques de *Medicago sativa* L. analogues à celles de *C. arvense* : la luzerne a aussi des racines verticales très longues et, en cas de lésions, elle forme également des bourgeons souterrains donnant naissance à des repousses aériennes.

Il décrit un cas qu'il a observé dans le district de Jouriev (Livonie), région située plus au nord que celle de la culture ordinaire de luzerne : après un hiver défavorable, toutes les parties souterraines de cette plante périrent au printemps et, quand le terrain fut dégelé, les racines se trouvaient pourries jusqu'à une profondeur notable. Cette parcelle ne fut pas



rompue et, au bout de quelques semaines, les racines produisirent de nouvelles pousses provenant d'une profondeur à laquelle on ne s'attendait guère, et couvrant le terrain d'une végétation non pas dense, il est vrai, mais qui se développa bien durant l'été.

D'après les observations qu'il a faites sur la luzerne pendant plusieurs années, l'A. considère comme probable que cette plante supporte bien l'hiver seulement quand ses racines ont atteint une profondeur notable et quand le terrain ne gèle pas, et il attire l'attention des expérimentateurs sur cette particularité.

314 — **Composition chimique du tabac durant sa période végétative; recherches en Russie.** — Кревс К. (KREVS K.), dans *Журналъ Опытной Агрономіи имени И. С. Коссовича* (Revue d'Agronomie expérimentale dédiée à la mémoire de P. S. KOS-SOVITCH), Tome XVII, Fasc. 4, pp. 278-288. Pétrograd, 1916.

Note préliminaire exposant les premiers résultats de recherches qui visaient à étudier dans quelle succession s'accumulent, chez le tabac, les substances contenues dans la plante mûre, pour contrôler chez les tabacs russes les données obtenues à l'étranger et pour les compléter par des données plus détaillées.

On employa un nombre considérable de plantes de la sorte « Trape-sonda », prélevées sur le champ du Laboratoire d'expériences concernant la culture du tabac à Iekaterinodar. Les tabacs étudiés ne peuvent être considérés comme typiques ni pour la région de Kuban, où se trouve ledit Laboratoire, ni pour d'autres régions de culture du tabac, parce qu'ils proviennent d'un champ de tchernoziom très gras, dont l'A. publiera l'analyse complète dans les *Annales* de ce Laboratoire.

On planta le tabac le 15 mai, et l'on en préleva successivement des échantillons aux dates suivantes : 4 — 15 — 26 juin ; 6 — 17 — 31 juillet ; 20 août. Dans les échantillons on détermina, séparément dans les feuilles, les tiges et les racines, les substances suivantes :

Cendre brute	Dextrine
Cendre pure et ses divers composants	Acides organiques volatils
Azote total	Acides organiques fixes (oxalique, citrique et malique)
Nicotine	Cellulose brute
Ammoniaque	Pentosanes
Matières protéiques	Matières grasses
Azote nitrique	Acide sulfurique
Sucres	Soufre organique.
Amidon	

Les résultats des déterminations faites sur 200 échantillons sont exposés dans plusieurs tableaux annexés au travail.

Les tabacs étudiés se distinguent des autres tabacs communément cultivés par l'*aspect extérieur* : ils sont plus hauts et possèdent des feuilles grosses et rêches, donnant une fumée forte et désagréable.

Sous le rapport de la *composition chimique*, il y a également des différences marquées entre les tabacs étudiés et les autres :

Ainsi, ils contiennent de 3 à 4 % de matières protéiques en plus que



les autres, en exceptant de ceux-ci la sorte de *Nicotiana rustica* dite « makhorta ».

Ils contiennent aussi davantage d'acides organiques fixes (malique et citrique).

D'autre part, ils se signalent par une forte teneur en azote nitrique : jusqu'à 5 %, alors que les tabacs d'autres régions se sont montrés pauvres en cet élément (traces — 0,3 %), sauf la sorte « makhorta », qui en contenait jusqu'à 1,1 %.

Enfin, ils se distinguent par une faible teneur en hydrates de carbone : Quoique tous les échantillons eussent été séchés rapidement, encore verts, on n'y a pas trouvé plus de 13 % d'hydrates de carbone chez des plants de repiquage, et à peine 9 % chez des plantes mûres, tandis que les tabacs de la partie méridionale de la région de Kuban séchés rapidement contenaient jusqu'à 40 % d'hydrates de carbone, sauf la sorte « makhorta », chez laquelle le taux d'hydrates de carbone se trouvait être égal à celui des tabacs étudiés, ou même plus faible.

D'une façon générale, les tabacs étudiés par l'A. lui paraissent être intermédiaires entre la sorte « makhorta » et les autres tabacs.

Pour le moment, l'A. s'abstient d'étendre aux autres tabacs les résultats qu'il a obtenus, mais il se propose de les contrôler sur les tabacs typiques de la région de Kuban.

315 - Résistance des plantes au froid par rapport à l'abaissement du point de congélation des suc cellulaires ; recherches aux Etats-Unis. — HARRIS ARTHUR J. et POPENOE WILSON, dans *Journal of Agricultural Research*, Vol. VII, N° 6, pp. 261-268. Washington, D. C., 1916.

La possibilité d'introduire des plantes tropicales d'importance économique dans les régions du Golfe du Mexique les plus chaudes, mais toutefois pas complètement exemptes du danger des gelées, est directement conditionnée par la plus ou moins grande capacité de résistance des espèces aux dépressions thermiques temporaires. En étudiant les phénomènes qui déterminent la résistance au froid, on attache ordinairement une importance particulière à l'abaissement du point de congélation des suc cellulaires. Plus cet abaissement est minime, plus la température où une certaine plante sera atteinte par la gelée est élevée, et, en conséquence, plus sa résistance spécifique à l'action des basses températures est faible.

L'avocatier (*Persea gratissima* Gaertn.) se prête fort bien à ce genre de recherches. Introduit depuis plusieurs années en Floride et en Californie, il se propage par voie asexuée, à tel point que le nombre des « variétés culturales » (sortes) est assez limité. On peut distinguer les types suivants :

1) *Type mexicain*, fréquent sur les plateaux du Mexique, d'où il s'est propagé au nord jusqu'en Californie, au sud jusqu'au Chili, grâce à sa résistance particulière aux basses températures. En Floride, il arrive jusqu'à Gainesville, et on le cultive aussi en Italie et en Algérie. En Californie, il fleurit de janvier à mars, et ses fruits mûrissent de juin à octobre. Il résiste sans en souffrir à des abaissements de température de — 6°,7 à — 8°,9 C. (comme on a pu le constater en janvier 1913).

2) *Type du Guatemala*. — C'est une plante indigène des montagnes du Guatemala et des régions les plus méridionales du Mexique, d'où il a été introduit ensuite aux îles Hawaï, en

Californie et en Floride. Dans cette dernière région, il fleurit de mars à mai et ses fruits mûrissent durant l'hiver ou au printemps suivant. Il est plus résistant au froid que la sorte provenant des Indes occidentales, sans atteindre toutefois, au dire des cultivateurs, la résistance spécifique de l'« avocado » mexicain.

3) *Type des Indes occidentales.* — Il pousse aux Indes occidentales, en Colombie, au Vénézuëla, au Brésil, au Pérou, dans le Yucatan et dans les régions côtières les plus chaudes du Mexique. On le cultive beaucoup en Floride, où il a été probablement introduit de l'île de Cuba. Il est particulièrement sensible aux basses températures.

Entre ces 3 types de *Persea gratissima*, l'A. a pu constater des différences considérables en ce qui concerne l'abaissement du point de congélation des suc cellulaires extraits des parties vertes de la plante (voir le Tableau ci-joint). L'abaissement du point de congélation pour les types du Mexique et du Guatemala est à peu près égal (la différence est de  $0,001 \pm 0,029$  de degré) et reste en moyenne au-dessous de  $10,21$  C. Pour le type des Indes Occidentales, l'abaissement moyen est inférieur à  $10,2$  C et il s'y maintient quelle que soit la provenance des plantes examinées : Indes Occidentales, Bahama, Amérique centrale, Mexique et Îles Hawaiï.

De ce qui précède, on pourrait donc conclure que la connaissance du point de congélation du suc cellulaire permet de prédire, dans certaines limites, le degré de résistance au froid d'une plante tropicale donnée, et d'en fixer la possibilité de propagation et de distribution géographique vers le nord.

*Valeur de l'abaissement du point de congélation  
pour les 3 types de Persea gratissima.*

Degrés centigrades	Type du Guatemala	Type du Mexique	Types du Guatemala et du Mexique	Type des Indes Occidentales
0,91-0,95 . . . . .	—	—	—	—
0,96-1,00 . . . . .	—	—	—	2
1,01-1,05 . . . . .	—	—	—	4
1,06-1,10 . . . . .	1	—	1	6
1,11-1,15 . . . . .	—	1	1	1
1,16-1,20 . . . . .	1	1	2	1
1,21-1,25 . . . . .	1	1	2	3
1,26-1,30 . . . . .	—	5	5	—
1,31-1,35 . . . . .	2	—	2	—
1,46-1,40 . . . . .	4	3	7	—
1,41-1,45 . . . . .	—	2	2	—
1,46-1,50 . . . . .	—	—	—	—
<i>Sommes des plantes . . .</i>	9	13	22	17

316 - Germination des graines de *Lepidium sativum* dans les solutions d'électrolytes. — L'ESAGE PIERRE, dans *Comptes Rendus des Séances de l'Académie des Sciences*, Tome 164, N° 2, pp. 119-121. Paris, 8 Janvier 1917.

L'A. a remarqué que, dans les solutions diluées de plusieurs sels (chlorures, nitrates, sulfates de sodium, potassium, ammonium), les graines de *Lepidium sativum* germent encore jusqu'à une certaine limite de concentration, voisine de 0,4 molécule-gramme par litre, et ce fait indiquerait, disait-il dans une Note récente (1), que la force osmotique de ces solutions joue un rôle important dans cette germination. Alors il n'envisageait pas le mode de dissociation qui se produit dans ces solutions diluées. Depuis, de nouveaux essais lui ont donné des résultats qui, en tenant compte de la dissociation, sembleraient ramener encore à cette idée du rôle important de la force osmotique dans la germination, au moins à ses débuts, sur ces solutions salines.

En supposant que cette force osmotique intervienne seule effectivement, au moins au début de la germination, les graines commenceront à germer dans les solutions de moins en moins diluées jusqu'à une certaine limite à laquelle ces solutions seront isotoniques quel que soit le sel, et la force osmotique commune pourra s'exprimer par  $M \times 22$ , en appelant  $M$  le même nombre de molécules-grammes ou la même fraction de molécule-gramme activement osmotique ; et 22 représentant, en atmosphères, la force osmotique correspondant à 1 molécule-gramme par litre.

L'A. a mis des graines à germer dans de minces couches de solutions, disposées en séries suffisamment larges, de chlorure de sodium et de glycérine, et il a trouvé ainsi des limites de germination qu'il exprime par  $m$  pour la glycérine et par  $n$  pour le chlorure de sodium,  $m$  et  $n$  représentant la fraction de molécule-gramme de ces corps dissous dans 1 litre.

S'il n'y avait pas de dissociation et si la germination ne tenait qu'à la force osmotique, on devrait avoir :  $m \times 22 = n \times 22$ , et  $m = n$ . Or, l'expérience donne assez sensiblement  $m = 2n$ . Mais la glycérine est non électrolyte, non dissociable, et le chlorure de sodium est électrolyte et dissociable ; la force osmotique de la glycérine peut s'exprimer par  $m \times 22$ , celle du chlorure de sodium est différente de  $n \times 22$ . Pour apprécier cette dernière, on appellera  $q$  la quantité dissociée en ions Na et en ions Cl ; les valeurs qui interviennent osmotiquement sont :  $n - q + q + q = n + q$ .

D'autre part, on dit que la dissociation du chlorure de sodium est très grande, presque totale ; si on l'imagine totale, alors  $q = n$ . Dans ces conditions, les valeurs qui interviennent osmotiquement, pour NaCl, ne sont plus  $n \times 22$ , mais  $2n \times 22$ , et l'isotonie est exprimée par  $2n \times 22 = m \times 22$ , d'où  $m = 2n$  correspond bien au résultat de l'expérience et montre que les débuts de la germination sont sous la dépendance immédiate de la force osmotique des solutions, quel que soit le corps dissous.

Avec les sels précédemment indiqués, il y aurait lieu de tenir compte de la dissociation en 2 ions des chlorures et nitrates, différente de celle des

(1) Voir B. Janvier 1917, N° 24.

(N. d. R.)



sulfates, qui se dissocient en 3 ions. Il y aurait surtout à bien préciser les limites de germination. L'A. le fera, et tout le porte à croire que les nouveaux résultats ne démentiront pas les premiers. En effet, des expériences en cours lui font supposer fortement que, si l'on représente en fraction de molécule-gramme les quantités de sel dissoutes par litre, on aura pour les solutions-limites de germination les valeurs suivantes :  $a$  pour NaCl,  $b$  pour KCl et  $c$  pour  $K^4 FeCy^3$ , telles que  $a \left( \frac{21}{48} \right)$  est un peu plus petit que  $b \left( \frac{24 \text{ à } 27}{48} \right)$ , et que  $c \left( \frac{10}{48} \right)$  est assez sensiblement voisin de  $\left( \frac{2 \times b}{5} \right)$ , ce qui correspond bien à ce que l'on sait de ces sels : les chlorures se dissocient en 2 ions, le NaCl en plus grande quantité que le KCl, et le ferrocyanure de potassium se dissocie en 5 ions.

Dans les mêmes expériences en cours, l'A. utilise comme non électrolytes l'alcool éthylique, la glycérine et le sucre ; les solutions de ces corps ne lui donnent pas la même satisfaction, pour le moment du moins ; mais ces expériences ne sont pas terminées et elles seront reprises.

Ces résultats permettent d'envisager les graines de *Lepidium sativum* comme utilisables dans la vérification de quelques cas discutables de dissociation, dans l'appréciation du degré de dissociation ou de la force osmotique de certaines liqueurs. Ces graines sont plus maniables, plus faciles à observer que des cellules isolées ou des tissus étudiés au microscope. Cela amène encore à penser que d'autres graines pourraient peut-être s'utiliser de la même manière, et invite à d'autres recherches dans cette voie.

317 - **Fonction des flavones chez les plantes.** — SHIBATA K. et NAGAI I., dans *The Botanical Magazine*, Vol. XXX, N° 352, pp. 149-178. Tokyo, 1916.

Résultats d'un grand nombre de recherches et d'expériences sur la présence et le rôle physiologique des flavones chez les plantes (1).

On mesure le pourcentage en flavones d'après l'intensité de la couleur rouge produite par réduction de l'extrait ; on distingue ainsi, par ordre décroissant, 6 degrés d'intensité (I—VI), qui correspondent à autant de titres en flavones dans le suc cellulaire :

I = 1 : 1 000	IV = 1 : 5 000
II = 1 : 2 000	V = 1 : 10 000
III = 1 : 3 000	VI = 1 : 20 000

Le Tableau I répartit, d'après leur teneur en flavones, 199 plantes de l'île de Formose et 80 plantes de la Micronésie.

Le Tableau II rassemble les données relatives à la teneur en flavones des divers organes ou parties de la plante.

En ce qui concerne la provenance des espèces, les taux de flavones les plus élevés sont signalés dans la Micronésie (tropicale), avec des valeurs presque identiques à celles connues pour les espèces alpines (dans la zone

(1) Voir B. Février 1917, N° 129.

(N. d. R.)

TABLEAU I. — *Teneur en flavones chez des plantes de Formose et de la Micronésie.*

Teneur en flavones	Plantes de Formose			Plantes de la Micronésie
	Nord	Sud	Total	
I-II . . . . .	48 (34,4%)	25 (42,2%)	73 (36,9%)	48 (59,5%)
III-IV . . . . .	44 (31,4%)	16 (28,1%)	60 (30,3%)	16 (20,3%)
V-VI . . . . .	33 (23,6%)	12 (20,3%)	44 (22,7%)	13 (16,5%)
Moins de 1 : 20 000 . . . . .	15 (10,7%)	6 (10,5%)	21 (10,6%)	3 (3,7%)
<i>Totaux</i>	140	59	199	80

Les chiffres en dehors des parenthèses indiquent les nombres de plantes possédant un taux de flavones donné.

TABLEAU II. — *Variations de la teneur en flavones chez les diverses parties de la plante.*

Teneur en flavones	Feuille	Bourgeon	Fleur	Écorce	Bois	<i>Totaux</i>
I . . . . .	46	1	1	2	1	51
II . . . . .	65	—	3	1	—	69
III . . . . .	35	—	—	2	—	37
IV . . . . .	30	3	1	2	—	36
V . . . . .	27	2	—	1	1	31
VI . . . . .	29	—	1	1	—	31
Moins de 1 : 20 000 . . . . .	17	2	—	3	2	24
<i>Totaux</i>	249	8	6	12	4	279

Les chiffres du Tableau indiquent les nombres de cas observés.

la plus élevée). Dans l'île de Formose (zone sub-tropicale), on remarque déjà une diminution sensible, surtout dans la section septentrionale, aussi bien pour les plantes spontanées que pour les plantes cultivées.

Les matériaux d'étude recueillis, tout en confirmant d'une part la fréquence des flavones chez les plantes, fournissent d'autre part des éléments utiles pour l'étude de la fonction propre de ces substances : protection de la plante contre l'excès de lumière. Les effets les plus évidents d'une insolation trop intense consistent en une dissolution de la chlorophylle et une décoloration des feuilles ; c'est pourquoi, dans les localités les plus chaudes et les plus exposées des tropiques, il n'est pas rare de trouver des arbres portant des feuilles presque complètement blanches, comme, par exemple, *Pisonia alba*. Les plantes disposent en général de divers moyens pour se

soustraire à l'action directe des rayons solaires, à savoir : abondant duvet sur les feuilles — enroulement ou repliement des jeunes feuilles — orientation des feuilles de façon que leurs surfaces viennent se disposer parallèlement à la direction des rayons. Mais il faut se rappeler que toutes ces mesures de protection contribuent aussi à limiter la transpiration et remplissent donc une double fonction, dont les limites et la signification ne sauraient être toujours déterminées avec précision.

Il est par contre une action protectrice beaucoup plus évidente et spécifique : celle des glucosides flavoniques dissous dans le suc cellulaire, lesquels ont la propriété d'absorber les rayons à petite longueur d'onde, si nuisibles aux corpuscules chlorophylliens et aux enzymes.

Les mangliers et les palmiers constituent sans doute les essences les mieux appropriées à la vie en plein soleil, en milieu fortement ensoleillé ; or, les mangliers des genres *Brugiera*, *Rhizophora*, *Kandellia*, *Avicennia*, *Lumnitzera* et *Sonneratia* contiennent tous, sans exception, une forte quantité (1 : 2 000—1 : 1 000) de flavones, dans leurs feuilles et dans le tissu cortical des racines aériennes.

Dans les hypocotyles des embryons « vivipares » bien connus de *Rhizophora mucronata*, le taux de flavones diminue des tissus superficiels aux tissus plus profonds, comme le montrent les chiffres suivants :

Tissus	Taux de flavones
Epiderme et couches corticales superficielles . .	II = 1 : 2 000
Parenchyme cortical . . . . .	IV = 1 : 5 000
Cylindre central . . . . .	VI = 1 : 20 000

Parmi les palmiers on distingue plusieurs espèces qui, tout en étant fournies de feuilles à tissus grossiers et capables de résister, par leur structure, à l'action des agents extérieurs, contiennent cependant de fortes quantités de flavones.

TABLEAU III. — Diminution des flavones chez les plantes tenues en serre.

Genres et espèces	Plantes ayant poussé à Formose	Plantes ayant poussé à Tokyo	
	en plein air	en serre	en plein air pendant l'été
<i>Carica papaya</i> . . . . .	II	traces	—
<i>Coffea arabica</i> . . . . .	(+) II	V	—
<i>Dracaena</i> . . . . .	II	traces	—
<i>Nepenthes</i> . . . . .	(+) I	V	—
<i>Erythroxylum Coca</i> . . . . .	(+) I	—	(+) I
<i>Mangifera indica</i> . . . . .	II	—	I
<i>Nephelium Longana</i> . . . . .	IV	—	IV
<i>Hibiscus Rosa Sinensis</i> . . . . .	III	—	traces



Même dans les conditions climatiques de Tokyo, les AA. ont constaté la présence d'une grande quantité de flavones chez les palmiers *Caryota urens*, *Livistona sinensis* et *Calamus Margaritae*, qui demandent à être protégés du froid seulement en hiver ; par contre, des exemplaires toujours tenus en serre, tels que *Raphis flabelliformis* et *Didymosperma Engleri*, ne contiennent presque point de flavones.

Ce phénomène se constate également chez d'autres essences (voir Tableau III) : plus le séjour en serre se prolonge, plus le taux de flavones diminue, leur fonction étant rendue inutile par le verre de la serre, lequel absorbe la plupart des rayons solaires les plus dangereux. De même, les plantes à cuticule très épaisse, capable d'exercer à elle seule une fonction protectrice, ne contiennent que de petites quantités de flavones, comme c'est le cas pour : *Yucca gloriosa*, *Agave vivipara*, *Fourcroya gigantea*, *Epiphyllum truncatum*, *Euphorbia Tirucalli*, diverses espèces du genre *Ficus*, etc.

On a dit à plusieurs reprises que les flavones peuvent se transformer facilement en anthocyanines, et viceversa. Les jeunes bourgeons, notamment dans les régions tropicales, présentent souvent une belle coloration rouge-bleue (anthocyanine), qui ensuite, à mesure que progresse le développement des organes végétatifs, disparaît pour faire place aux glucosides flavoniques colorés. D'autre part il arrive souvent que ces derniers se transforment de nouveau en anthocyanine, un peu avant la chute des feuilles.

Le fait le plus important, et qui présente un caractère physiologique évident, est sans doute la présence des flavones dans les tissus ; leur transformation temporaire en anthocyanine est un phénomène sûrement secondaire, un processus biochimique déterminé par l'influence prédominante de certaines conditions particulières, externes et internes.

318 - **Comportement des substances de réserve non azotées chez les arbres.** — ANTEVS ERNST, dans *Arkiv für Botanik*, Vol. 14, N° 3, pp. 1-23. Stockholm, 1916.

Cette étude sur la nature, le comportement et l'équilibre des substances de réserve dans les arbres a conduit l'A. à des résultats importants, en partie contraires aux théories et aux idées dominant jusqu'ici. Les expériences furent exécutées durant la période 16 mars à 11 mai 1915 et les prélèvements, aux fins d'analyse, furent effectués successivement à des intervalles de 6 à 8 jours. Les réactifs employés étaient : Soudan III pour les matières grasses ; chlorure de zinc iodé pour l'amidon.

UNE NOUVELLE MATIÈRE GRASSE DE RÉSERVE. — FISCHER classe les arbres en 3 catégories :

1) « Arbres à matières grasses » où, vers la fin de l'automne, tout l'amidon disparaît pour se transformer en matière grasse et, en partie minime, en glucose (en correspondance avec l'écorce).

Parmi les espèces de cette catégorie, l'A. a examiné : *Pinus* sp., *Sorbus aucuparia*, *Tilia* sp., *Alnus* sp., *Betula* sp., *Picea* sp. et *Salix caprea*.

2) « Arbres à amidon » dans lesquels, vers la fin de l'automne, seul l'amidon de l'écorce disparaît, tandis que celui qui est contenu dans la masse ligneuse reste intact : *Ulmus* sp.

3) Chez *Prunus Padus*, il se produit des phénomènes intermédiaires.

Quelques auteurs avaient déjà affirmé l'existence de substances de réserve non azotées encore inconnues. Le présent travail confirme cette thèse. Des arbres à substances grasses, comme ceux du genre *Alnus*, peuvent, pendant l'hiver, être complètement dépourvus de leur matière grasse ordinaire et de leur amidon, et posséder par contre une substance grasse spéciale qui, sous l'effet du réactif Soudan III, se colore en jaune-paille ou en jaune-brun. D'autres espèces (*Salix caprea*, *Prunus Padus*) renferment également une forte quantité de cette nouvelle substance, en même temps que la matière grasse type et que l'amidon. A l'époque de la régénération de l'amidon, cette substance se transforme partiellement en matière grasse et en amidon.

RAPPORT DES DIFFÉRENTES SUBSTANCES DE RÉSERVE ENTRE ELLES. — L'apparition et la solubilisation de l'amidon et de la matière grasse dans les fruits et dans les graines corrobore l'idée d'un rapport constant entre les deux substances ; on peut même parler, dans certains cas, d'un véritable équilibre physiologique entre les matières grasses et l'amidon, d'une nature toutefois très compliquée. L'A. admet qu'un état d'équilibre identique se répète pour toutes les substances de réserve transformables, comme les matières grasses, l'amidon, le glucose, etc., dont la transformation serait réglée par des enzymes spéciales. Les différences de comportement et de proportion de ces substances seraient dues au fait que certaines espèces sont pourvues de cette enzyme et d'autres pas. Les arbres à amidon ne posséderaient pas l'enzyme qui en permet la transformation en matière grasse, enzyme qui peut toutefois disparaître lorsque les conditions du milieu se modifient. Le *Prunus Padus* qui, dans l'Europe centrale et le Danemark, est un arbre-type à amidon, passe en Suède dans la catégorie intermédiaire où l'on constate une solubilisation partielle de l'amidon.

TRANSFORMATION DES SUBSTANCES DE RÉSERVE SELON LE CLIMAT. — La remise en circulation de la matière grasse et la réapparition de l'amidon au printemps sont étroitement liées à la marche des facteurs météorologiques. En 1913, le retour imprévu de la belle saison, avec des journées chaudes et ensoleillées, détermina une reprise rapide de ces phénomènes, tandis que le froid et les pluies des 11-13 avril provoquèrent une solubilisation de l'amidon nouvellement formé et en conséquence une augmentation de la teneur en matières grasses (*Pinus*, *Picea*). (Voir le tableau ci-joint). En comparant les résultats obtenus par l'A. aux constatations faites dans l'Europe centrale, on voit clairement que la transformation en matière grasse durant l'hiver est plus complète à mesure que la latitude s'élève. La cause de ce phénomène ne peut être cherchée ailleurs que dans le climat. On ne possède guère de données sur les régions tropicales ; toutefois, on peut admettre que plus on s'approche de l'Équateur, plus le processus de solubilisation de l'amidon tend à s'atténuer pour disparaître totalement dans les zones les plus chaudes.

En sus de l'action du climat, les phénomènes intrinsèques de croissance influent nettement sur les processus de transformation qui se rattachent étroitement au retour automatique et cyclique des périodes de repos, les-

quelles sont, jusqu'à un certain point, indépendantes des oscillations du climat. Ainsi, la transformation de l'amidon en matière grasse, prélude de l'arrêt hivernal, commence lorsque la température est encore élevée et ne saurait, en conséquence, influencer sur ce phénomène.

RÔLE BIOLOGIQUE DE LA MATIÈRE GRASSE EN HIVER. — Selon FISCHER, la transformation de l'amidon en matière grasse sert à protéger le protoplasme contre les basses températures; aussi, dans une même espèce, le processus de transformation est-il d'autant plus complet que l'on s'avance davantage vers le nord. Tandis que, durant l'hiver, le bois des arbres supporte des dépressions thermiques allant jusqu'à  $-30^{\circ}$  C., en été il suffit d'un refroidissement de  $-8^{\circ}$  à  $-10^{\circ}$  pour déterminer la congélation. La résistance plus grande des arbres pendant l'hiver peut précisément s'expliquer par la présence des matières grasses.

Espèce de plante et date de l'observation *	Amidon				Matières grasses			
	Ecorce		Bois		Ecorce		Bois	
	Partie externe	Partie interne	Rayons médul- laires	Moelle	Partie externe	Partie interne	Rayons médul- laires	Moelle
<i>Pinus</i>								
16 mars . . . . .	0	0	0	0	10	9	9	9
22 » . . . . .	0	0	0	0	10	9	9	9
30 » . . . . .	0	2	2	4	6	3	5	4
5 avril . . . . .	6	6	3	4	2	3	4	2
12 » . . . . .	0	1	3	—	2	3	3	4
19 » . . . . .	5	2	1	4	5	4	4	5
27 » . . . . .	3	3	3	4	4	2	4	5
5 mai . . . . .	6	6	3	0	1	2	3	3
16 » . . . . .	6	4	2	5	5	3	4	4
<i>Ulmus</i>								
16 mars . . . . .	0	0	9	10	7	5	0	0
22 » . . . . .	0	0	9	10	7	5	0	0
30 » . . . . .	0	3	8	10	6	5	0	0
5 avril . . . . .	1	1	7	10	3	3	0	0
12 » . . . . .	0	2	2	4	2	2	0	0
19 » . . . . .	3	1	0	0	3	2	0	2
27 » . . . . .	1	1	4	6	0	1	0	0
5 mai . . . . .	4	2	4	—	2	2	0	1
11 » . . . . .	0	0	0	0	2	1	0	0

\* Les chiffres de 1 à 10 indiquent la quantité relative des différentes substances.



319- Effets du manganèse et du fer sur le développement du blé. — TOTTINGHAM W. E. et BECK A. J., dans *The Plant World*, Vol. 19, N° 12, pp. 359-370, 2 fig. Baltimore, 1916.

Expériences visant à étudier le rapport et l'effet des chlorures de fer et de manganèse sur la croissance du blé en culture aqueuse : solution de KNOP avec phosphate monopotassique et exclusion du phosphate de fer, les deux sels susdits étant employés à 2 titres différents : N/ 10 00 et N/ 100 000.

Les plantules de blé étaient retirées des pots de culture au bout de 3 semaines ; on en mesurait les racines en calculant la moyenne de 2 ou 3 des groupes radicaux les mieux développés ; on séparait les racines des parties aériennes, on desséchait à 98° C et l'on procédait aux pesées.

TABLEAU I. — Résultats de la 1<sup>re</sup> série d'expériences.

	Témoin (solution simple de KNOP)	Chlorure manganéux, petite dose	Chlorure de ferrique, petite dose	Mn Cl <sup>2</sup> et Fe Cl <sup>3</sup> à petites doses	Mn Cl <sup>2</sup> à forte dose	Fe Cl <sup>3</sup> forte dose	Mn Cl <sup>2</sup> et Fe Cl <sup>3</sup> , fortes doses
<i>Parties aériennes desséchées :</i>							
Poids absolu . . . . .	330 mg	490 mg	785 mg	495 mg	360 mg	325 mg	305 mg
Poids relatif (témoin = 100) . . . .	100	140	224	142	103	93	87
<i>Racines desséchées :</i>							
Poids absolu . . . . .	230 mg	210 mg	330 mg	230 mg	170 mg	135 mg	145 mg
Poids relatif (témoin = 100) . . . .	100	91	144	100	74	59	63
<i>Racines fraîches :</i>							
Longueur maximum. . . . .	198 mm	173 mm	200 mm	153 mm	183 mm	63 mm	60 mm
Longueur relative (témoin = 100). .	100	87	101	77	92	32	30

TABLEAU II. — Résultats de la 2<sup>ème</sup> série d'expériences.

	Témoin	Na H CO <sup>3</sup> , petite dose	Na H CO <sup>3</sup> et Mn Cl <sup>2</sup> , petites doses	Na H CO <sup>3</sup> et Fe Cl <sup>3</sup> , petites doses	Na HCO <sup>3</sup> Mn Cl <sup>2</sup> Fe Cl <sup>3</sup> , petites doses	Na HCO <sup>3</sup> , forte dose	Na H CO <sup>3</sup> et Mn Cl <sup>2</sup> , fortes doses	Na H CO <sup>3</sup> et Fe Cl <sup>3</sup> , fortes doses	Na H CO <sup>3</sup> Mn Cl <sup>2</sup> Fe Cl <sup>3</sup> , fortes doses
<i>Parties aériennes des- séchées :</i>									
Poids absolu. . .	621 mg	632 mg	453 mg	647 mg	566 mg	260 mg	250 mg	854 mg	725 mg
Poids relatif (té- moin = 100) . .	100	102	73	104	91	42	40	138	117
<i>Racines desséchées :</i>									
Poids absolu. . .	221 mg	228 mg	185 mg	249 mg	191 mg	163 mg	117 mg	210 mg	195 mg
Poids relatif (té- moin = 100) . .	100	103	84	113	87	74	53	95	88
<i>Racines fraîches :</i>									
Longueur maximum	275 mm	233 mm	278 mm	265 mm	295 mm	231 mm	233 mm	260 mm	298 mm
Longueur relative. (témoin = 100) .	100	85	101	96	107	84	85	95	108

Dans la 1<sup>ère</sup> série d'expériences, les deux chlorures étaient ajoutés en même temps ou séparément à la solution nutritive. Les résultats obtenus se trouvent groupés dans le Tableau I, qui permet de faire les constatations suivantes :

1) *En ce qui concerne l'appareil radical*, le chlorure manganeux, même à petites doses, est nuisible et annule complètement les effets positifs du chlorure ferrique. En effet, tandis que ce dernier, employé seul, semble favoriser le développement de la racine (longueur relative égale à 101), associé au chlorure manganeux il donne au contraire une croissance relative égale à 77.

A un titre plus élevé, l'un et l'autre sel ont une action toxique ; en particulier le chlorure ferrique met obstacle aux effets du chlorure manganeux, c'est-à-dire l'emporte sur celui-ci.

2) *En ce qui concerne les parties aériennes*, le chlorure manganeux à petites doses, au lieu d'avoir une action déprimante, paraît stimuler la plante à un développement plus rapide. Au point de vue de l'antagonisme, ce qui a été noté pour les racines se répète ici.

Une 2<sup>ème</sup> série d'expériences furent exécutées afin d'établir si la toxicité du chlorure ferrique à fortes doses est due à l'acidité produite par hydrolyse de ce sel. Pour maintenir neutre la solution nutritive, on y ajoutait du bicarbonate de sodium aux titres N/ 333 et N/ 33 333, associé ou non aux deux chlorures. Comme il résulte de l'examen du Tableau II, le chlorure manganeux, en présence du bicarbonate de sodium, même à petites doses, est nuisible non seulement aux racines, mais aussi aux parties vertes de la plante.

A hauts titres, le bicarbonate de sodium exerce une action nettement toxique, tandis que le chlorure ferrique, contrairement à ce qu'on avait constaté dans la première série d'expériences, favorise l'accroissement des pousses terminales, circonstance due évidemment à l'alcalinité de la solution nutritive.

320 - **Hybridations de blé supprimant certains caractères et faisant apparaître des caractères nouveaux, en Angleterre.** — BIFFEN R. H., dans *Journal of Genetic*, Vol. 5, N° 4, pp. 225-228. Cambridge, 1916.

SÉLECTION.

Le blé poulard ou *Triticum turgidum* (« Rivet Wheat ») appartient à la catégorie des blés à glumes grises (« grey chaffed »), caractère lié à la présence de poils soyeux sur les glumes (« rough chaffed wheats » = blés à glumes rêches).

L'A. a croisé *Triticum turgidum* avec *T. polonicum* (blé de Pologne), qui se distingue par la longueur des glumes (3 fois la longueur ordinaire), blanches et à peine couvertes d'un léger duvet. Les hybrides de la 1<sup>ère</sup> génération ( $F_1$ ) avaient tous des glumes d'un gris pâle (« Isabelline white »), c'est-à-dire la couleur de *T. polonicum* avec une légère teinte grisâtre analogue à la teinte bleuâtre que l'on observe parfois sur les campanules blanches, où elle constitue un signe d'hybridation, une trace de sang bleu (campanules bleues). Le gris qui, dans les croisements avec le rouge (« Rivet Wheat » × « Red Fife ») se montre généralement *dominant*, tendait au contraire, dans ce cas, à devenir *récessif*.

Dans la 2<sup>ème</sup> génération d'hybrides ( $F_2$ ), il y avait des individus à glumes longues, d'autres à glumes courtes, d'autres enfin à glumes moyennes; les premiers étaient glabres, tandis que les deuxièmes et les troisièmes avaient des glumes couvertes de poils (« rough chaffed »), mais tous étaient absolument blancs (comme *T. polonicum*) et ils se maintinrent tels dans les générations suivantes: ainsi, dans la  $F_6$ , sur 100 000 plantes il n'y en avait pas une seule qui ne fût blanche. Le gris de *T. turgidum* restait donc complètement supprimé.

I'A. relie hypothétiquement ce fait de la suppression d'un caractère par hybridation avec le phénomène bien connu de l'apparition, dans la  $F_2$ , de caractères n'existant chez aucun des géniteurs. Des blés rouges croisés entre eux ont produit souvent des individus à grains blancs, suivant le rapport 1 : 15. Dans ce cas, on pourrait en quelque sorte parler d'une *suppression du rouge*, laquelle se produit dans la  $F_2$  1 fois sur 16.

NILSSON-EHLE explique l'apparition de caractères nouveaux par l'existence de *plusieurs déterminants* du rouge:  $C - C_1 - C_2$ ,... etc.

Dans le cas de 2 déterminants, les géniteurs sont représentés respectivement par les formules  $Cc_1$  et  $C_1c$ ; les hybrides de la 1<sup>ère</sup> génération ( $Cc_1 C c$ ) produisent 4 sortes de gamètes:  $CC_1 - Cc_1 - C_1c - cc_1$  — qui, dans la 2<sup>ème</sup> génération d'hybrides ( $F_2$ ), se combinent comme le montre le Tableau ci-joint.

*Constitution des hybrides de la 2<sup>ème</sup> génération ( $F_2$ ) dans le cas de 2 déterminants.*

		Gamètes mâles			
femelles	♂	$CC_1$	$Cc_1$	$C_1c$	$cc_1$
	♀				
	$CC_1$	$CC_1CC_1$	$CC_1Cc_1$	$CC_1C_1c$	$CC_1cc_1$
	$Cc_1$	$Cc_1CC_1$	$Cc_1Cc_1$	$Cc_1C_1c$	$Cc_1cc_1$
	$C_1c$	$C_1cCC_1$	$C_1cCc_1$	$C_1cC_1c$	$C_1ccc_1$
Gamètes	$cc_1$	$cc_1CC_1$	$cc_1C_1c$	$cc_1C_1c$	<b><math>cc_1cc_1</math></b>
		Constitution des hybrides			

La combinaison de  $cc_1$  avec  $cc_1$  se produit seulement 1 fois sur 16 et, comme il suffit de 1 *seul* déterminant  $C$  pour donner le rouge, il ne peut y avoir dans la  $F_2$  que 1 *seul* hybride complètement blanc.

Dans le cas de 3 déterminants du rouge, le nombre d'hybrides non rouges (blancs) sera, dans la  $F_2$ , de 1 sur 64.



Enfin, on a pu étudier récemment un rapport 1 : 3 chez l'hybride entre « Squarehead's Master » et un blé chinois rouge non déterminé, et chez un autre hybride entre « Squarehead's Master » et un blé chinois blanc : on obtint dans la  $F_2$  des individus aristés, suivant le rapport 1 : 3, bien que les géniteurs fussent tous deux mutiques.

Il semble à l'A. possible que tous ces cas représentent les termes d'une série qui commencerait par la suppression *totale* d'un caractère, laquelle se limiterait ensuite successivement à : 1 fois sur 4 — 1 fois sur 16 — 1 fois sur 64 — et ainsi de suite.

321 — **Sélection du tournesol à la Station agronomique régionale de Saratov, Russie.** — Суворова В. (SOUVOROV V), dans *Журналъ Опытной Агрономии имени П. С. Коссовича* (Revue d'agronomie expérimentale dédiée à la mémoire de P. S. KOSSOVITCH), Tome XVII, Fasc. 3, pp. 255-256. Pétersbourg, 1916.

L'A. reproduit les résultats de la sélection du tournesol (1), publiés par E. M. ПЛАТЧЕК (ПЛАЧЕКЪ Е. М.) et A. I. СТЕВУТЪ (СТЕБУТЪ А. И.) dans le 5<sup>ème</sup> Volume des *Travaux de la Section de sélection de la Station agronomique régionale de Saratov*.

Les expériences ont été faites au cours des années 1912-1913 et 1914. Parmi les 3 groupes bien définis de tournesol cultivé : 1) Groupe à graines servant d'aliment ; 2) Groupe servant à l'extraction de l'huile ; 3) Groupe intermédiaire entre ces deux-là, la Section en question s'est principalement arrêtée à l'étude du tournesol à huile, comme étant pratiquement le plus important pour la région. Les travaux de sélection du tournesol se faisaient dans deux sens : d'une part, la Section avait cherché à isoler les variétés, en se basant sur les caractéristiques morphologiques externes ; d'autre part, on avait en vue la possibilité de créer des variétés résistant aux maladies et ennemis, surtout à l'*Orobanche cumana*. Le premier but, l'isolement des variétés morphologiquement distinctes entre elles, en plus des difficultés que l'on rencontre toujours chez les plantes à fécondation croisée, fut entravé par le fait qu'on n'arrivait pas à scinder le tournesol en variétés ayant chacune son individualité bien distincte. S'il existe des variétés semblables, il faut reconnaître que les variétés cultivées de tournesol représentent un mélange d'un assez grand nombre d'entre elles. Ce mélange est presque une variété, hybride, et non sujette à être sélectionnée, soit naturellement, soit artificiellement. D'après les données de la Section, les divers exemplaires de tournesol, pendant toute leur période végétative, ne manifestent pas une distinction nette l'un de l'autre en ce qui concerne leurs caractéristiques externes. Leur étude biométrique, accompagnée de la comparaison de leurs caractéristiques diverses, n'a pas amené la fixa-

(1) Vers 1840, le tournesol n'était connu en Russie que comme plante d'ornement. Ensuite, dans la province de Saratov, on commença à le cultiver pour la production des graines, consommées comme friandise. Quelques années plus tard, le paysan БОКАРЕВ, de la province de Voronège, essaya d'extraire des graines de tournesol l'huile ; celle-ci fut trouvée d'un goût excellent et, à partir de ce moment, la culture de cette plante commença à s'étendre. En 1846, aux environs de Saratov, on sema en tournesol 50 ha ; en 1852, il y en eut 980 ha, et,

tion de types bien distincts. On n'y a pas réussi, même en essayant de fixer les types de tournesol d'après la grandeur et la forme des akènes.

Aussi la Section a-t-elle renoncé pour le moment à tout essai de faire la classification générale du tournesol; elle s'est arrêtée à l'étude d'un même groupe de caractéristiques des akènes, et, pour caractéristique fondamentale, on a pris la coloration de ceux-ci. Par la présence ou l'absence de la couche cuirassée et de la coloration en bandes, tous les tournesols

en 1853, 1 370 ha. En 1913, la superficie cultivée en tournesol dans tout l'Empire était de 901 941 ha. Le Tableau suivant fournit des données détaillées concernant cette année-là.

**Culture du tournesol en Russie en 1913.**

Régions et provinces	Superficie	Production totale	Rendements à l'ha
<b>RUSSIE D'EUROPE :</b>			
Koursk. . . . .	18 971 ha	186 273 qx	9,7 qx
Tambov. . . . .	50 596	439 261	8,7
Voroneje. . . . .	245 599	1 922 383	7,8
Sarator. . . . .	164 736	1 145 209	6,9
Penza. . . . .	2 903	2 740	9,4
Kherson. . . . .	8 461	91 118	10,8
Tauride. . . . .	1 314	10 457	7,9
Iékatérinoslav. . . . .	7 797	86 646	11,1
Région du Don. . . . .	36 060	279 476	7,8
Kharkor. . . . .	37 127	329 427	8,8
Poltava. . . . .	5 237	61 758	11,7
<i>Totaux pour la Russie d'Europe . . .</i>	<i>578 805</i>	<i>4 554 816</i>	<i>7,9</i>
<b>CAUCASE SEPTENTRIONAL :</b>			
Région de Kouban. . . . .	298 492	2 220 794	7,5
Stavropol. . . . .	8 420	47 571	8,7
<i>Totaux pour le Caucase septentrional</i>	<i>306 912</i>	<i>2 268 365</i>	<i>7,3</i>
<b>RUSSIE D'ASIE :</b>			
Région de l'Amour. . . . .	649	6 179	9,4
Région de Turgaisk. . . . .	8 428	23 742	2,8
Région de Semipalatinsk. . . . .	1 460	6 556	4,5
Région de Semirietchensk. . . . .	5 684	32 000	5,6
<i>Total pour la Russie d'Asie. . . . .</i>	<i>16 223</i>	<i>68 478</i>	<i>4,2</i>
<i>Totaux pour l'Empire Russe . . . . .</i>	<i>901 941</i>	<i>6 892 660</i>	<i>7,6</i>

En 1913, la superficie totale cultivée en tournesol dans tout l'Empire avait augmenté d'environ 6 %, comparativement à celle de l'année précédente. Le rendement à l'ha était d'environ 5,7 quintaux.

Voir : 1) *Encyclopédie complète agricole russe*, Vol. VII, p. 394. Pétrograd 1902. A. F. DEVRIEN, éditeur. — 2) *DIRECTION GÉNÉRALE DE L'ORGANISATION AGRAIRE ET DE L'AGRICULTURE, Recueil de données statistiques et économiques sur l'industrie agricole en Russie et dans les pays étrangers*, VIII<sup>ème</sup> Année, pp. 126-128. Pétrograd, 1915.

(N. d. R.)

cultivés se réduisent à quelques types fondamentaux seulement, plus ou moins résistants, dans le sens de l'hérédité du type de l'akène. Grâce aux observations ultérieures, on a pu établir ensuite une certaine corrélation entre la coloration des akènes et les dimensions et la forme des feuilles chez les plantes. Cependant, toutes les phases de la végétation de tous ces types, depuis le bourgeonnement jusqu'à la maturité complète, se produisaient assez uniformément ; il ne s'était même manifesté aucune dépendance vis-à-vis du type de l'akène, ni dans la longueur de la tige, ni dans le diamètre du disque, etc. Il ne s'est manifesté une distinction nette entre les types que dans la densité de la plantation : égale pour tous au début de la végétation, elle est apparue, au moment de la récolte, comme ayant fortement diminué chez quelques types. Cela indique que les divers types étudiés supportent diversement les conditions défavorables et ont un degré différent de résistance aux maladies.

En effet, les types de tournesol établis d'après la coloration des akènes souffraient diversement de la *Homoeosoma nebulella* et de la *Puccinia Helianthi*. Cependant, la principale ennemie du tournesol, c'est l'*Orobanche cumana*. Par rapport à cette dernière cause adverse, la Section avait déjà, dès le commencement de ses travaux, noté que les exemplaires des variétés « zelenka » et « amerikanka » étaient moins frappés par l'*O. cumana*. Les années suivantes, la Section s'est occupée sérieusement de la question du choix et de la création des formes résistant héréditairement à l'*O. cumana*. Les observations faites ont démontré que les types de tournesol à huile, établis d'après la coloration des akènes, se distinguent entre eux par leur différent degré de résistance à l'*O. cumana*, car la résistance est une propriété de caractère mendélien, capable de se scinder, etc. Enfin, on a établi les lignées que l'*O.* n'atteint pas du tout. Par conséquent, dans cette direction, la Section a obtenu des résultats importants et précieux.

Quant à l'isolement des variétés de tournesol morphologiquement bien distinctes, il exige encore beaucoup de travail, et actuellement il est encore prématuré de parler des variétés solidement fixées.

322 — **La sélection du fraisier aux États-Unis.** — DARROW M. GEORGE, dans *The Journal of Heredity*, Vol. VII, N° 12, pp. 531-540, 6 fig. Washington, D. C., 1916.

Ces dernières années, la sélection n'a pas peu contribué à améliorer la qualité des fraisiers dans les états de Kentucky, West-Virginia, Maryland et Delaware, surtout grâce à l'activité de deux sélectionneurs : CLOUD et HUBACH. Deux nouvelles sortes seront introduites incessamment : « Payday » et « Perfecto ».

La sorte « Payday », obtenue par croisement de la sorte « Klondike » avec une plante-mère caractérisée par l'absence presque complète d'étamines, est certainement le meilleur type et elle l'emporte sur la « Klondike » elle-même par la qualité et la couleur de ses fruits, sa productivité, sa croissance vigoureuse et le court intervalle entre la floraison et la maturation des fruits.

Au moment où les fleurs tombent, les branches florifères se recourbent vers le bas, de sorte que les fruits restent couverts par le feuillage, qui les préserve des gelées, des vents froids et de la pluie. Un autre caractère



précieux de la sorte « Payday », c'est l'acidité de ses fruits qui, sans altérer leur parfum, leur permet de mieux résister à l'emballage et au transport. M. CLOUD a créé jusqu'ici, par hybridation, les sortes suivantes :

Sortes		Hybridations
Cloud	provenant de	Crescent × Wilson
Big Bob	» »	Cumberland Triumph × Neuman
Lulu	» »	Crescent × Neuman
Pickerproof	» »	Lulu × Hoffman
Klondike	» »	Pickerproof × Hoffman.
Payday	» »	Plante non déterminée × Klondike
Perfecto	» »	Plante non déterminée × Klondike

La méthode suivie par un autre sélectionneur : M. HUBACH, est intéressante. On plante isolément, dans un petit enclos recouvert de gaze, 4 pieds de fraisier à fleurs dépourvues d'étamines (type pistillé). Pour effectuer l'hybridation, il n'y a qu'à prendre une fleur avec pollen mûr et la placer, renversée, sur la fleur d'une plante pistillée. L'opération doit être faite le matin de bonne heure et elle réussit très facilement. La graine produite est recueillie et conservée pendant 1 an ; durant cette période, les graines de mauvaise qualité perdent leur faculté germinative. On sème vers la mi-mai dans des couches spéciales formées d'un mélange de terre stérilisée et de fumier bien décomposé, à parties égales. Lorsque, sur les jeunes plantes, la 3<sup>ème</sup> ou la 4<sup>ème</sup> feuille commencent à pousser, on élimine celles qui ont moins bonne apparence, en se basant sur la corrélation des caractères se manifestant dès les premiers stades du développement. Au moment de la maturation des fruits, on fait un nouveau choix, en isolant les meilleurs types, sur lesquels on peut effectuer de nouveaux croisements si l'on veut modifier certains caractères ou en ajouter de nouveaux. En suivant ce système, HUBACH a créé une nouvelle sorte, la « Famous », qui possède tous les caractères appréciables de la « Klondike » tout en lui étant, à de nombreux égards, supérieure. Les fruits de la « Famous » arrivent à maturité 2 semaines avant ceux de la « Klondike », avec une légère avance sur l'« Excelsior » ; chaque pétiole ne porte en général qu'un seul fruit ; aussi les fraises sont-elles mieux développées et de dimensions plus uniformes pendant toute la période de production. On ne sait encore que peu de chose de la productivité, de la résistance aux maladies et de la compacité des fruits de la « Famous » ; s'ils étaient aussi satisfaisants à cet égard, l'on pourrait ajouter une nouvelle sorte de premier ordre aux types cultivés dans le sud.

Par des croisements opportuns, HUBACH s'efforce actuellement de créer une sorte réunissant les avantages de la sorte « Klondike » au caractère tardif de la sorte « Aroma ».

En dehors de CLOUD et de HUBACH, d'autres savants et producteurs ont beaucoup travaillé à l'amélioration de cette culture. Quels sont les résultats obtenus ? Il y a trente ans, les états du sud n'exportaient pas de fraises ; par contre, en 1914, sur 14 553 wagons exportés des États-Unis, 8 369 provenaient des états du Sud où le fraisier n'est pas une

plante indigène, de sorte que son introduction, son acclimatation et sa sélection sont dues entièrement et directement aux spécialistes et aux cultivateurs. Sur la superficie totale plantée en fraisiers dans les états de : Kentucky, West-Virginia, Maryland et Delaware, la sorte « Klondike » occupe 79 %, l'« Aroma » 8 %, la « Missionary » 7 %, la « Gandy » 2 %, l'« Excelsior » 2 %, la « Thompson » 1 %, et l'ensemble des autres sortes le 1 % restant. Ce sont : Hathaway, St-Louis, Mitchel, Jamestown, Dixie, Ozark, Neuman, Nick Ohmer, Market, Eureka, Mellie, Champ Clark, Buchach, Hefflin, Three W., Corneille. Ces données montrent qu'en fait toutes les sortes cultivées dans le sud sont de création et d'origine locales. Quelques-unes d'entre elles se sont propagées en dehors de cette zone ; c'est le cas de la « Klondike », beaucoup cultivée aussi en Californie et dans l'Illinois. Quoique les résultats obtenus jusqu'ici soient déjà excellents en eux-mêmes, des améliorations ultérieures sont certainement encore possibles. Le type idéal, que les spécialistes s'efforcent de créer, devrait posséder les caractères suivants : 1) présenter une grande résistance aux maladies, comme la sorte « Aroma » ; 2) fournir une abondante production de stolons, comme la « Klondike » et l'« Aroma » ; 3) avoir, dans chaque groupe, une productivité jamais inférieure à celle de la sorte indigène la plus productive ; 4) avoir une floraison parfaite et abondante ; 5) avoir les inflorescences bien protégées contre la gelée, comme celles de la « Missionary » ; 6) les fruits devraient garder une grosseur uniforme pendant toute la période de production, comme c'est le cas pour l'« Aroma » et la « Chesapeake » ; 7) le fruit devrait toujours garder la même forme, comme cela se produit pour la « Chesapeake » quand les conditions du milieu lui sont particulièrement favorables ; 8) la chair des fraises devrait être compacte comme celle de la « Klondike » ; 9) les fruits devraient pouvoir être cueillis facilement, avoir une couleur rouge-brun tant au-dedans qu'au dehors, et être au moins aussi gros que ceux la « Klondike ». Ce sont là des caractères généraux, susceptibles d'être influencés, selon les cas, par des exigences d'ordre purement local. Ainsi, dans certaines régions, les producteurs recherchent les types à maturité précoce, qui leur permettent de faire la récolte de bonne heure et de s'occuper ensuite d'autres travaux agricoles ; les confiseurs préfèrent les sortes à fruits d'un rouge sombre, se détachant facilement de la branche et conservant leur forme même après la cuisson. Le travail de sélection poursuivi selon de bons principes et avec une méthode appropriée permettra de créer peu à peu pour chaque région le type qui répond le mieux aux nécessités climatologiques et commerciales de l'endroit.

323 - ***Pyronia*, hybride entre le poirier et le cognassier.** — TRABUT L., dans *Journal of Heredity*, Vol. VII, N° 9, pp. 416-419, 2 fig. Washington, D. C., 1916.

En 1913, VEITCH (Londres) réussit à obtenir, entre *Pyrus* (poirier) et *Cydonia* (cognassier), un hybride qu'il nomma *Pyronia*. Sous le climat de l'Angleterre, cet hybride, très ornemental, ne réussit pas à mûrir ses fruits. En vue d'obtenir cette maturation, l'A. a effectué des expériences dans un pays plus chaud : l'Algérie, en greffant des rameaux de *Pyronia* sur un poirier marocain : *Pyrus gharbiana* Trabut. En novembre de la même année (1913), les scions avaient déjà acquis une longueur de 2 m et la gros-

seur du pouce à leur base. En 1911 les premiers fruits apparurent et, au printemps de 1915, la plante fleurit et fructifia de nouveau, abondamment. L'A. a donné à cette plante le nom de *X Cydonia Veitchii* var. *John Leden*.

Cette nouvelle création présente les caractères suivants :

*Feuilles* vert-clair, avec une forme particulière de préfoliation intermédiaire entre la préfoliation condupliquée de *Cydonia* et la préfoliation involutée de *Pyrus* ; en effet, tandis qu'une moitié du limbe foliaire s'enroule comme chez le poirier, l'autre moitié, au lieu de s'enrouler symétriquement, recouvre parfaitement la première, comme un manchon.

Le *fleurs* sont réunies par groupes de 3 à l'extrémité des rameaux florifères et, à quelques exceptions près, chaque fleur produit un fruit. La 1<sup>ère</sup> floraison est suivie d'une 2<sup>ème</sup>, à fleurs isolées à l'extrémité des branches ; enfin, au commencement de l'automne, il y a une 3<sup>ème</sup> floraison, mais dans ce cas les fruits se forment sans pouvoir mûrir.

Les *fruits*, qui mûrissent en octobre-novembre, sont tous dépourvus de pépins : dans les premières phases du développement, on distingue encore nettement les 2 séries d'ovules dans les loges, mais plus tard ils disparaissent. La forme du fruit est caractéristique : cylindrique, un peu plus longue que large, avec un pédoncule court et les lobes du calice persistants ; la chair, blanche, compacte, douce, avec une légère acidité, conserve tout le parfum caractéristique du coing.

VEITCH range cet hybride dans un nouveau genre, *Pyronia*, mais, les botanistes n'admettant même pas la validité du genre *Cydonia*, la classification de VEITCH est certainement discutable au point de vue scientifique.

Au point de vue de la fructiculture, le *Pyronia* constitue assurément un nouveau fruit excellent qui, convenablement amélioré et cultivé, pourrait donner de très bons résultats dans toute la région méditerranéenne.

324 - **Variations d'un hybride sexuel de vigne par sa greffe sur l'un de ses procréateurs.** — BACO F., dans *Comptes Rendus hebdomadaires des Séances de l'Académie des Sciences*, Tome 163, N° 23, pp. 712-714. Paris. 4 Décembre 1916.

Il y a une dizaine d'années LUCIEN DANIEL, dans ses études sur la greffe des plantes herbacées (1), attirait l'attention sur les modifications bonnes ou mauvaises provoquées par la symbiose chez le sujet et le greffon. En particulier il montrait que, en greffant sur des sujets convenables, on pouvait parfois produire une disjonction de caractères parentaux, une mosaïque nouvelle, un renforcement ou une atténuation de certaines propriétés spécifiques, la transmission de quelques-unes d'entre elles, et même provoquer l'apparition de caractères nouveaux. Appliquant ces théories

(1) LUCIEN DANIEL : La variation dans la greffe et l'hérédité des caractères acquis, dans *Annales des Sciences naturelles, Botanique*, 1898 — Variations des races de haricots sous l'influence du greffage, dans *Comptes Rendus de l'Académie des Sciences*, Tome 130, 1900, p. 665 — etc.



à la vigne, A. JURIE (1) et P. CASTEL (2) améliorèrent leurs hybrides sexuels et obtinrent des hybrides de greffe qui ont fait leur chemin en viticulture.

À la mort de ces hybrideurs connus, l'A. a essayé lui-même de perfectionner par la même méthode les hybrides sexuels de vigne qu'il avait créés et il a obtenu des hybrides sexuels-asexuels bien supérieurs aux pieds mères (3). En 1916, il a observé un cas des plus remarquables de transformation de son hybride 11-16 avec changement de mosaïque et apparition chez le greffon de caractères latents provenant du sujet et de l'un de ses ancêtres maternels. L'hybride 11-16 provient d'un croisement fait en 1907 entre le 24-23 BACO (Folle blanche × *Riparia*) pris pour père et le 4-13 BACO (Sauvignon × 4401 COUDERC) pris comme mère. Dans cet hybride sont prédominantes les qualités paternelles. La feuille ressemble à celle du 24-23 par la grandeur, le facies et la forme ; le pétiole a une longueur variable entre 4 et 8 cm et il est de couleur rouge ; le limbe a l'aspect américain, sans découpures profondes bien nettes ; il est glabre, avec nervures légèrement velues, long de 11 à 12 cm et large de 15 cm au plus. Le sinus pétiolaire est obtus et les feuilles des entre-cœurs sont à peine découpées. Les grappes sont lâches, de petite taille, à grains noirs peu nombreux, à chair dure un peu foxée ; ils contiennent en général un seul pépin, assez gros, à bec gros et court, à caractère américain.

En 1912, l'A. a greffé en mixte le 11-16 sur l'un de ses parents, le 4401 COUDERC (Chasselas rose × *Rupestris*), à feuilles découpées et à dents peu aiguës comme le Chasselas, qui est remarquable par la longueur de son pétiole rouge brun (13 cm). Aucun greffon ne conserva les caractères du pied-mère et l'un d'eux fut complètement transformé. Le pétiole de ses feuilles s'allongea comme chez le Chasselas et atteignit de 7 à 10 cm ; le limbe changea de forme, devint long de 8 à 10 cm et large de 9 à 11 cm ; il acquit les découpures d'un *Vitis vinifera* tout en conservant l'état lisse des vignes américaines ; son sinus pétiolaire se rétrécit comme chez les vignes françaises parentes. La longueur des entre-nœuds de la tige resta plus petite ; la teinte et la striation changèrent également. La grappe devint 2 fois plus longue et plus large ; ses raisins, nombreux et serrés comme chez l'ancêtre Sauvignon, furent plus gros, plus tendres, plus juteux et sans goût foxé. La structure anatomique montra de même une accentuation des caractères de la vigne française. En un mot, les appareils végétatif et reproducteur avaient été influencés simultanément par le 4401, sujet qui avait accentué les caractères ancestraux communs au greffon et à lui-même, et les avait amenés de l'état latent à l'état dominant dans l'hybride de

(1) A. JURIE : Sur un cas de déterminisme sexuel produit par le greffage mixte, dans *Comptes Rendus de l'Académie des Sciences*, Tome 133, 1901, p. 445 — Un nouveau cas de variation de la vigne à la suite d'un greffage mixte. *Ibidem*, p. 1246. (N. de l'A.)

(2) P. CASTEL : De l'amélioration des producteurs directs par la greffe (*Congrès agricole de Toulouse*, 1904). (N. de l'A.)

(3) F. BACO : Sur des variations de vignes greffées, dans *Comptes Rendus de l'Académie des Sciences*, Tome 148, 1909, p. 429 — Bouturage comparé de vignes greffées et de vignes franches de pied. *Ibidem*, Tome 156, 1913, p. 1167 — etc. (N. de l'A.)

greffe nouveau. Le 4401 avait imprimé au greffon 11-16 des qualités très supérieures comme production et valeur des raisins (caractère provenant du Chasselas et du Sauvignon), sans nuire aux résistances et à la vigueur (caractères du *Riparia* et du *Rupestis*).

Cet exemple confirme les résultats obtenus par DANIEL, JURIE et CASTEL et montre une fois de plus, s'il en était besoin, que la greffe est, en certains cas, un agent de variation très puissant, capable, chez les hybrides sexuels, de changer la latence ou la dominance des caractères communs aux ancêtres du greffon et du sujet. Il existe donc une sorte de cryptométrie de greffe. Dans le nouveau groupement de la mosaïque qui résulte de l'influence exercée sur l'hybride sexuel par sa greffe sur l'un de ses procréateurs, il peut y avoir amélioration sans détérioration au point de vue utilitaire, comme chez l'hybride de greffe 11-16 obtenu par l'A. Mais le cas inverse peut se produire, et l'on ne saurait trop insister sur l'importance du choix des sujets quand on veut perfectionner par la greffe un hybride sexuel de vigne et amener la séparation des éléments antagonistes.

CÉRÉALES ET  
LÉGUMINEUSES  
À GRAINE.

325 - **Les sortes de blé hongrois sélectionnées (1) au service de l'accroissement de la production nationale.** — GRABNER, EMLE, dans *Köztelek*, Année 26, N° 41, pp. 1459-1460. Budapest, 7 Octobre, 1916.

Les nombreuses expériences effectuées dans les différentes zones de la Hongrie ont confirmé que le blé hongrois sélectionné, depuis 1905, par M. SZÉKÁCS à Arpádhalom, a de beaucoup surpassé toutes les autres sortes indigènes améliorées, non seulement par son rendement en grain, mais aussi par la résistance à la rouille et sa paille robuste. Pour assurer la récolte et augmenter la production nationale on s'est donc efforcé, au cours des 2 dernières années, de remplacer le blé indigène local par des sortes plus productives de Arpádhalom, non seulement sur les grands domaines, mais aussi sur des terres des petits propriétaires. D'après le calcul de l'A., les semis d'automne de 1916 provenant des meilleurs types de Arpádhalom couvriront une superficie de plus de 600 000 arpents cadastraux (345 300 ha) appartenant aux petits propriétaires, dont les faibles productions ont généralement diminué les rendements moyens du pays. Ce fait constitue donc un grand pas en avant, si l'on considère que  $\frac{3}{4}$  des superficies cultivées en blé sont entre les mains des petits propriétaires d'esprit conservateur qui, sauf dans quelques districts, n'ont pas encore réalisé cette substitution. Or, c'est seulement par l'accroissement de leurs productions que les rendements optima du pays entier pourraient être assurés.

C'est précisément dans ce sens que M. POESZ, chef de l'Inspection royale agricole du comitat de Mosony, commença ses travaux dans l'automne de 1915, en distribuant 28,5 wagons de semences provenant de Arpádhalom entre 385 petits propriétaires de 25 communes. Avant la distribution de ces semences, il fit tenir des conférences populaires en vue de vulgariser parmi ces petits propriétaires les notions sur la valeur productive des blés en ques-

(1) Voir à ce sujet : B. 1913, N°s 353 et 133 — B. 1914, N°s 224 et 421 — B. 1915, N° 166. (N. d. R.).

tion, ainsi que sur la méthode systématique de culture rationnelle du blé sélectionné. De cette façon l'Inspection de l'Agriculture n'a pas seulement veillé à ce que les petits propriétaires aient des sortes plus productives, mais elle a visé en même temps à améliorer leurs procédés culturaux. En outre, on les a invités à faire des expériences comparatives avec les semences indigènes locales et à recueillir les observations des résultats obtenus. Les rapports envoyés jusqu'à maintenant à l'Inspection (seulement 72) ont tous reconnu unanimement les bonnes qualités des types d'élite de Arpádhalom. Voici quels ont été les rendements en grain :

Localités	Rendements en kg par <i>arpent cadastral</i>	Rendements en kg à l'ha
1 . . . . .	500	869
1 . . . . .	500-600	869-1 043
2 . . . . .	600-700	1 043-1 217
9 . . . . .	700-800	1 217-1 391
19 . . . . .	800-900	1 391-1 564
19 . . . . .	900-1 000	1 564-1 738
19 . . . . .	1 000-1 100	1 738-1 912
2 . . . . .	1 200-1 250	2 085-2 172

Les cultivateurs qui ont récolté dans une localité 500 à 600 kg par *arpent cadastral* (869 à 1 043 kg à l'ha) ont obtenu dans une autre 1 000 kg (1 738 kg à l'ha), ce qui montre que les rendements moindres ne doivent être attribués qu'aux conditions climatiques défavorables. Ceux qui ont fait des expériences comparatives ont obtenu par *arpent cadastral* des excédents moyens de 200 kg (348 kg à l'ha) en faveur des blés sélectionnés ; dans les milieux plus favorables, les excédents ont été de 254 à 633 kg par *arpent cadastral* (442 à 1 100 kg à l'ha).

Ces données ont d'autant plus de valeur qu'elles ne représentent qu'une partie des superficies ensemencées, dont les façons culturales ont souvent été exécutées par des ouvrières agricoles.

Selon l'A., la grande valeur de ces travaux réside surtout en ce que les rendements sont déterminés d'une façon très exacte, et en l'espoir que la production des sortes éprouvées s'étendra, de sorte que sous peu toute la superficie cultivée en blé dans le comitat de Mosony sera ensemencée avec les graines de Arpádhalom. Avec les 28,5 wagons de semences susdits on a commencé, en 1915, plus de 3 000 *arpents cadastraux* (1 727 ha), dont le rendement peut être évalué, d'après les calculs susmentionnés, à 27 000 quintaux environ. Or, même si l'on déduit de cette quantité celle employée pour une autre fin, on peut estimer à 30 000 *arpents cadastraux* (17 265 ha) les superficies ensemencées en 1916 qui seront capables de fournir un surplus de 45 000 à 60 000 quintaux (étant donné une augmentation de 1 à 2 quintaux par *arpent cadastral*).

Il n'y a pas de raison pour que les petits propriétaires des autres comitats du pays ne puissent obtenir des excédents de rendement semblables ; aussi l'A. invite-t-il les autorités compétentes des autres comitats à prêter



leur assistance à l'amélioration de la culture de blé des petits propriétaires de la manière relatée plus haut, pour vulgariser en faveur de la production nationale les beaux résultats obtenus par les sélectionneurs du pays.

326 — **Le blé « Manitoba » en Italie et en France.** — SIGNORINI M., dans *Il Coltivatore*, 63<sup>ème</sup> Année, N° 2, 54-59. Casale Monferrato, 1916.

En parlant de blé « Manitoba », on comprend sous une seule dénomination l'ensemble des blés provenant de cette région. En général, dans l'ensemble des blés de même provenance, une variété bien distincte prédomine, à savoir la plus répandue et la plus cultivée au lieu d'origine. Ainsi, dans le « Manitoba » introduit en Italie et en France, pour l'alimentation nationale, prédomine parmi les diverses variétés un blé qui donne des épis minces, effilés, très faiblement aristés, à glumes pointues de couleur rosée. Ce blé a des caractères identiques à ceux du *Red Fife* très répandu dans le nord des États-Unis et au Canada, et VILMORIN propose de renoncer à la dénomination vague de « Manitoba » pour celle, plus exacte, de *Fife rouge*. Celui-ci est le plus répandu et le plus renommé des blés de printemps, surtout dans l'Amérique septentrionale, vu les conditions favorables du climat et du terrain. Il serait donc nécessaire de sélectionner, de croiser et d'étudier le blé « Manitoba » avant de le conseiller comme culture de printemps en Europe. En attendant, voici un résumé des résultats cultureux obtenus jusqu'ici en Italie et en France.

**I t a l i e.** — STÉVANO, qui a fait l'essai de plus d'une vingtaine de blés provenant de Winnipeg, capitale du Manitoba, déclare avoir trouvé de bonnes variétés, dont quelques-unes peuvent être recommandées, à grains petits, blonds, gonflés, de force moyenne.

Les blés du Manitoba mûrissent en général fin juin ou commencement de juillet, et donnent un rendement assez rémunérateur, avec une paille de hauteur moyenne et plus forte que celle du « Cologne ». Il serait opportun de poursuivre ces études et ces essais, en sélectionnant les sortes s'adaptant le mieux aux différents points de la péninsule.

CAMPBELL a fait, dans la province de Caserte, une expérience qui a donné de bons résultats, et il conseille la culture du « Manitoba » particulièrement dans le midi de l'Italie, si l'on n'a pas pu semer la variété locale en temps opportun. Enfin VOLANTI signale qu'un agriculteur de Frugarolo (province d'Alexandrie) obtint, il y a quelques années, une récolte très abondante et très belle d'une culture de printemps du blé « Manitoba », copieusement fumé.

**F r a n c e.** — SCHRIBAUX a ouvert une enquête parmi les agriculteurs qui, en 1916, cultivèrent le « Manitoba » fourni par le Gouvernement. Bien que les cultures soient très hétérogènes : épis blancs, rouges, aristés, mutiques, soit un ensemble très varié pour les raisons exposées plus haut, d'une façon générale les agriculteurs français se sont toutefois prononcés favorablement. On ne doit pas oublier que :

1) Le « Manitoba » donne de bons résultats, et une récolte pouvant dépasser 20 quintaux à l'ha, même si la semaille est très tardive et si les variétés locales ne peuvent plus être cultivées avec succès. La semence doit être

abondante, afin de suppléer au tallage restreint de la plante : en moyenne 150 kg de semence par ha.

2) Le « Manitoba » offre une grande résistance à l'échaudage, qui cause tant de dégâts aux blés de mars, et une bonne résistance à la rouille.

3) Le « Manitoba » est robuste, très précoce et résiste aux vents marins, caractère très important.

4) Il faut éviter de le semer dans des terrains très argileux et naturellement humides, où il a donné de mauvais résultats.

5) Il faut, autant que possible, bien fumer le terrain, car une plante à développement rapide a toujours besoin d'être aidée par un engrais ; on pourra ainsi obtenir une forte production.

### 327 - Sur des procédés culturaux tendant à augmenter la productivité du blé. —

DEVAUX H., dans *Comptes Rendus des Séances de l'Académie des Sciences*, Tome 164, N° 4, pp. 191-193. Paris, 22 Janvier 1917.

L'A. a entrepris en 1915 et en 1916, aux environs de Bordeaux, des essais de culture du blé suivant la méthode DEMTCHINSKY, par semis précoce et espacé, buttages répétés et repiquage des plants les plus beaux. Il a mis en culture les 4 variétés : Hybride inversable de Vilmorin — Rouge de Bordeaux — Bon Fermier — Rieti barbu — et il a constaté que toutes poussent bien et qu'elles produisent un nombre extraordinaire d'épis, par l'effet du traitement susdit. Le Blé rouge de Bordeaux, l'une des variétés qui ont le moins tallé, a produit, sur 6 m<sup>2</sup>, 177 touffes à 9,5 tiges en moyenne par touffe, soit au total 1 687 tiges, ce qui correspond à une moyenne de 30 touffes environ par m<sup>2</sup>, avec 261 tiges, dont 116 produites par 6 grosses touffes.

### 328 - Essais comparatifs de céréales et de lins à graine dans le Montana et le Wyoming, États-Unis. —

I. DONALDSON N. C., Cereal Experiments at the Judith Basin Substation Moccasin, Montana, dans *United States Department of Agriculture, Bulletin* N° 398, 41 pp., 17 fig. Washington, 12 Octobre 1916. — II. JONES, JENKIN W., Cereal Experiments on the Cheyenne Experimental Farm Archer, Wyoming, dans *United States Department of Agriculture, Bulletin* N° 430, 39 pp., 12 fig. Washington, 28 Octobre 1916.

I. — Essais comparatifs de céréales et de lins à graine faits pendant 8 ans (1908-1915) à la Sous-Station de Judith Basin, située à 1300 m d'altitude à Moccasin, centre-ouest du comté de Fergus, au milieu de l'état de Montana.

Bien que les récoltes obtenues à Moccasin ne représentent pas l'étendue entière des terres arides de cet état, l'A. estime néanmoins que les résultats comparatifs qu'il a obtenus peuvent être appliqués d'une façon générale à toute l'étendue aride du Montana.

Pendant la période de 18 ans 1898-1915, il y a eu à Moccasin une *précipitation annuelle moyenne* de 432 mm et une *chute de pluie saisonnière moyenne* (avril-mai-juin-juillet) de 240 mm.

Le sol de Moccasin est une glaise argileuse foncée (« dark clay loam ») dérivant d'un calcaire.

En général, on y obtient de bonnes récoltes de : blé d'automne et de printemps — avoine de printemps — orge — lin à graine.

Les meilleurs blés d'automne sont les sortes « Kharkov » et « Turkey » appartenant au groupe des blés durs de Crimée. Pour la semaille, la meilleure





*Jaunes hâtives:*

Sixty-Day . . . . .	165	29 avril	6 juillet	7 août	100 jours	927 mm	2 726 kg	2 519 kg	44,53 kg (b)
Khetson . . . . .	459	<i>id.</i>	<i>id.</i>	<i>id.</i>	<i>id.</i>	922	2 601	2 546	44,53 » (b)

*Blanches de mi-saison:*

Siberian (c) . . . . .	741	21 avril	21 juillet	15 août	114 jours	1 219 mm	2 572 kg	3 611 kg	47,10 kg
Swedish Select, . . . . .	134	29 »	17 »	17 »	110 »	1 067	2 525	3 038	47,62 » (d)
Danish . . . . .	441	29 »	17 »	18 »	111 »	991	2 432	2 813	41,57 » (d)

## ORGES.

*Vêlues, à 2 rangs:*

White Smyrna . . . . .	195	18 avril	6 juillet	4 août	108 jours	737 mm	2 846 kg	2 843 kg	62,03 kg
Hamchen . . . . .	531	18 »	11 »	6 »	110 »	813	2 577	2 574	62,29

*Vêlues, à 2 rangs:*

Coast . . . . .	600	18 avril	6 juillet	5 août	109 jours	813 mm	2 582 kg	2 579 kg	59,20 kg
Mariout . . . . .	261	18 »	5 »	5 »	109 »	787	2 518	2 514	59,46

*Nues, à 6 rangs:*

Himalaya . . . . .	620	18 avril	6 juillet	5 août	109 jours	787 mm	1 716 kg	2 131 kg	78,51 kg
Nepal . . . . .	595	18 »	8 »	5 »	109 »	828	1 625	2 071	78,51

## LINS.

*Lins à graine européens:*

Russian (North Dakota N° 155)	19	8 mai	20 juillet	28 août	112 jours	584 mm	1 070 kg	1 818 kg	72,07 kg
Select Russian (North Dakota N° 1215) . . . . .	3	<i>id.</i>	<i>id.</i>	<i>id.</i>	<i>id.</i>	584	995	1 802	72,07
Select Riga (North Dakota N° 1214) . . . . .	2	<i>id.</i>	<i>id.</i>	<i>id.</i>	<i>id.</i>	579	995	1 630	71,69
North Dakota N° 1221 . . .	16	<i>id.</i>	<i>id.</i>	<i>id.</i>	<i>id.</i>	574	982	1 612	71,69
Fargo Common (North Dakota N° 1133) . . . . .	18	<i>id.</i>	<i>id.</i>	<i>id.</i>	<i>id.</i>	559	970	1 551	71,69

(a) Moyenne des 6 années 1910-1915. — (b) Moyenne des 5 années 1909, 1911, 1913, 1914, 1915. — (c) Moyenne des 3 années 1913-1915. — Moyenne des 4 années 1910, 1913, 1914, 1915.

dose de semence est celle de 56 litres par ha, et la meilleure époque celle comprise entre le 10 août et le 10 septembre.

Quant aux blés de printemps, ceux qui ont donné les plus hauts rendements sont des sortes de *Triticum durum*, notamment la sorte « Pelissier ». Parmi les blés de printemps ordinaires, le meilleur paraît être « Marquis ». On les sème à raison de 85 litres par ha.

On obtient les meilleurs résultats en semant toutes les céréales de printemps : blé — avoine — orge — aussitôt que les conditions de sol et de climat le permettent

Parmi les avoines, c'est la sorte « Sixty-Day » qui donne les plus hauts rendements : 10,8 quintaux par ha de plus que les variétés à maturation tardive. Pour les avoines à petit grain, comme la sorte « Sixty-Day », la meilleure dose de semence est celle d'environ 87 litres par ha.

Parmi les orges, c'est la sorte à 2 rangs vêtue et barbue « White Smyrna » qui a donné les plus hauts rendements moyens. On sème les orges vêtues à raison de 109 litres par ha, et les orges nues à raison de 87 litres par ha.

Le lin qui a donné les plus forts rendements, durant 5 ans d'essais, est celui de Russie. On obtient probablement les meilleurs résultats en semant le lin de bonne heure : entre le 15 avril et le 1<sup>er</sup> mai, à raison de 22 à 28 kg par ha.

Pour le rendement unitaire, l'orge « White Smyrna » vient en tête, suivie de : blé d'automne « Kharkov » — avoine « Sixty-Day » — orge nue « Nepal » — blé de printemps « Pelissier » — lin « Russian ».

Pour la valeur du rendement unitaire, basée sur le prix à l'exploitation au 1<sup>er</sup> décembre de chaque année, on a l'ordre décroissant suivant : blé d'automne « Kharkov » — orge « White Smyrna » — lin « Russian » — avoine « Sixty Day » — blé dur de printemps « Pelissier » — orge nue « Nepal ».

L'engrain double (*Triticum dicoccum*) et l'épeautre ne donnent pas d'aussi bons rendements que l'orge et l'avoine.

On a essayé le millet « Proso » (*Panicum miliaceum*), mais il n'est pas promettant.

Les sortes hâtives des sorghos « brown kaoliang » et « broom corn » ont été mises à l'essai, mais elles ne mûrissent pas leurs grains.

Le Tableau I expose les données moyennes obtenues à Moccasin, de la semaille à la récolte, pour :

7 sortes principales de blé d'automne ; moyennes des 7 années 1909-1915.

9 sortes principales de blé de printemps ; moyennes des 7 années 1908-1911 et 1913-1915 (pour la longueur des plantes, moyennes des 6 années 1909-1911 et 1913-1915 — pour le poids de 1 hl de grain, moyennes des 5 années 1910-1911 et 1913-1915).

5 sortes principales d'avoine ; moyennes des 7 années 1908-1911 et 1913-1915 (pour la longueur des plantes, moyennes des 6 années 1909-1911 et 1913-1915 — pour le rendement unitaire en paille, moyennes des 5 années 1909-1910 et 1913-1915).

6 sortes principales d'orge ; moyennes des 5 années 1910-1911 et 1913-1915.

5 sortes principales de lin ; moyennes des 5 années 1911-1915 (pour le poids de 1 hl de graine, moyennes des 4 années 1912-1915).

II. — La « Cheyenne Experiment Farm » (exploitation d'essais de Cheyenne) est située à 1 800 m d'altitude sur le plateau au sud-est de l'état

de Wyoming, dans la localité d'Archer, à 13 km à l'est de Cheyenne. Elle a été établie en juillet 1912 et a commencé ses expériences l'automne de la même année ; celles dont on publie les résultats ont duré 3 ans.

Le sol et le climat de cette exploitation représentent bien ceux du district oriental du Wyoming. Les résultats qu'on y a obtenus peuvent être appliqués à la partie sud-est du Wyoming et à de petites portions adjacentes du Colorado, du Nebraska et du South-Dakota.

Le sol est sablo-argileux, léger, très productif quand il a assez d'humidité. Il y a des terres plus lourdes dans d'autres parties du district.

À Cheyenne, durant les 16 dernières années, la *précipitation annuelle moyenne* a été de 400,6 mm, contre une *précipitation saisonnière moyenne* (avril-mai-juin-juillet) de 218,2 mm.

Pour la même période, l'*évaporation d'une nappe d'eau libre* pendant la saison de croissance (avril à juillet inclus) a été d'environ 571 mm.

Les *étés* sont plutôt courts, sans chaleur excessive. — Il n'y a *pas de vents chauds*. — La *période sans gelées* est en moyenne de 125 jours.

Les *blés d'automne* (avec les sortes « Ghirka Winter » et « Kharkov » en tête) ont donné de plus forts rendements que les blés de printemps durant 2 des 3 années d'essais. — Sous le rapport de la quantité de semence à employer, des expériences avec les sortes « Ghirka Winter » et « Turkey » ont donné des résultats contradictoires durant les 3 ans. Il semble que la meilleure dose soit celle de 87 litres de semence à l'ha. C'est en semant de bonne heure : 1<sup>ère</sup> moitié de septembre, qu'on a obtenu les plus forts rendements moyens.

Quant aux *blés de printemps*, ils ont moins produit que ceux d'automne. Les blés durs, avec les sortes « Bielotourka » et « Kubanka » en tête, se sont montrés supérieurs, sous ce rapport, aux blés de printemps ordinaires, dont les sortes du groupe « Preston » ont surpassé celles des groupes « Fife » et « Bluestem ». — Pour la quantité de semence à employer, les expériences avec blés durs ne sont pas concluantes : jusqu'ici on a obtenu de la sorte « Arnautka » les plus forts rendements en la semant à raison de 43,5 litres par ha. Pour les blés de printemps ordinaires, c'est en semant de bonne heure : vers le milieu d'avril, qu'on a obtenu les plus hauts rendements.

Parmi les *avoines*, ce sont les sortes hâtives qui ont donné les plus hauts rendements moyens dans 2 des 3 années d'essais. En 1915, année froide et humide, ce sont les sortes de mi-saison qui ont le mieux réussi. Durant les 3 années d'essais, c'est la sorte « Swedish Select » qui a produit les plus hauts rendements moyens. — Sous le rapport de la quantité de semence à employer, on a constaté, pour la sorte « Kherson », qu'une dose de 130,5 litres à l'ha procurait de plus hauts rendements que des doses inférieures à ce chiffre. C'est en semant de bonne heure : vers la mi-avril, qu'on a obtenu les meilleurs résultats.

Parmi les *orges*, ce sont les sortes à 2 rangs vêtues et barbues « White Smyrna » et « Hannchen » qui ont donné les plus forts rendements moyens. — Pour la quantité de semence à employer, on a constaté que la sorte « Svanhals » produisait davantage quand elle était semée à raison de 43,5 et de 62,75



TABLEAU II. — Données moyennes obtenues à Archer, de l'épiage à la récolte.

Groupes et sortes	C. I. N°	Dates moyennes de		Longueur moyenne des plantes	Poids de 1 hectolitre de grain	Rendements à l'ha		Rapport Grain : Paille
		l'épiage	la maturité			Grain	Paille	
BLÉS D'AUTOMNE.								
Groupe « Ghirka » :								
Ghirka d'automne . . . . .	I 438	29 juin	28 juillet	686 mm	79 kg	I 224 kg	2 259 kg	I : I,85
Groupe de Crimée :								
Kharkov . . . . .	I 442	29 juin	26 juillet	711 mm	75 kg	I 157 kg	2 429 kg	I : 2,10
Crimean . . . . .	I 559	29 »	26 »	711	77	I 157	2 068	I : I,79
Crimean . . . . .	I 432	2 juillet	30 »	660	78	I 130	2 757	I : 2,44
Turkey . . . . .	I 571	29 juin	26 »	711	27	I 116	2 284	I : 2,05
Malakoff . . . . .	2 908	2 juillet (a)	31 » (a)	762	80	I 076	I 980	I : I,84
Crimean . . . . .	I 437	29 juin	27 »	686	75	I 049	2 019	I : I,93
BLÉS DE PRINTEMPS.								
Groupe « Durum » :								
Bielotourka . . . . .	I 520	13 juillet	18 août	711 mm	80 kg	I 089 kg	I 360 kg	I : I,25
Kubanka . . . . .	I 516	id.	17 »	686	79	I 069	I 368	I : I,28
Pererodka . . . . .	I 350	id.	18 »	737	80	I 049	I 562	I : I,49
Kubanka . . . . .	I 440	id.	18 »	686	79	I 022	I 340	I : I,31
Groupe « Preston » :								
Erivan . . . . .	2 397	15 juillet	15 août	533 mm	75 kg	915 kg	I 330 kg	I : I,46
Red Russian . . . . .	4 141	16 »	16 »	610	75	841	I 425	I : I,70
Spring Turkey . . . . .	4 154	17 »	17 »	635	77	820	I 388	I : I,69
Non classés :								
Galgalos . . . . .	2 398	15 juillet	16 août	559 mm	76 kg	881 kg	I 100 kg	I : I,25
Defiance . . . . .	3 703	18 »	18 »	635	68	592	I 190	I : 2,01
Groupe « Fife » :								
Cole Hybrid . . . . .	4 062	17 juillet	18 août	686 mm	75 kg	868 kg	I 410 kg	I : I,64

Chirka de printemps . . . . .	1 517	14 »	16 »	635	73	726	1 136	1 : 1,57
Ryting . . . . .	3 022	20 »	18 »	635	70	632	1 452	1 : 2,30
Glyndon (Minnesota No 163) . .	2 873	18 »	19 »	584	72	625	1 367	1 : 2,19
Groupe « <i>Bluestem</i> » :								
Haynes (Minnesota No 169) . .	2 874	18 juillet	19 août	610 mm	66 kg	565 kg	1 226 kg	1 : 2,17
Marvel . . . . .	3 082	21 »	21 »	635	69	471	1 284	1 : 2,73
AVOINES.								
<i>Hâtives</i> :								
Sixty-Day . . . . .	165	7 juillet	1 août	584 mm	44 kg	850 kg	901 kg	1 : 1,06
Kherson . . . . .	459	7 »	31 juillet	610	43	829	800	1 : 0,97
<i>De mi-saison</i> :								
Swedish Select . . . . .	134	20 juillet	13 août	711 mm	47 kg	1 062 kg	1 377 kg	1 : 1,30
Colorado No 37 . . . . .	619	21 »	14 »	635	49	997	1 254	1 : 1,26
Ligowo . . . . .	492	21 »	14 »	711	51	990	1 380	1 : 1,40
Silvermine . . . . .	714	20 »	12 »	711	48	968	1 190	1 : 1,23
Abundance . . . . .	731	21 »	16 »	711	48	958	1 192	1 : 1,25
<i>Tardives</i> :								
Black Tartarian . . . . .	768	21 juillet	14 août	660 mm	49 kg	807 kg	1 082 kg	1 : 1,34
ORGES.								
<i>Vêlues, à 2 rangs</i> :								
White Smyrna (Onchac) . . . .	658	12 juillet	1 août	457 mm	61 kg	1 141 kg	1 105 kg	1 : 0,96
Hannchen . . . . .	531	14 »	9 »	483	64	1 056	1 122	1 : 1,05
Hanna . . . . .	24	22 »	8 »	483	63	913	1 302	1 : 1,41
<i>Vêlues, à 6 rangs</i> :								
Coast . . . . .	690	8 juillet	2 août	533 mm	51 kg	1 099 kg	1 178 kg	1 : 1,01
Manchuria (Minnesota No 6) . .	638	12 »	3 »	559	52	918	1 172	1 : 1,26
Horsford . . . . .	877	9 »	2 »	610	50	839	1 061	1 : 1,25
Manchuria (Minnesota No 105) .	354	10 »	3 »	533	52	833	1 226	1 : 1,45
<i>Nues, à 6 rangs</i> :								
Black Hull-Ices . . . . .	1 106	14 juillet	8 août	483 mm	79 kg	791 kg	1 133 kg	1 : 1,13

(a) Moyennes de 2 années seulement.

litres par ha qu'à des doses plus élevées ; et elle a donné les meilleurs rendements après une semaille plutôt précoce : du milieu à la fin d'avril.

En comparaison des rendements du blé, ceux de l'avoine de printemps et de l'orge de printemps ont été plutôt bas. L'avoine d'hiver et l'orge d'hiver n'ont pas réussi.

Ni l'*engrain double* d'hiver ; ni celui de printemps n'ont montré de valeur.

Les millets « Foftail » (*Setaria italica*) et « Proso » (*Panicum miliaceum*) n'ont donné que de faibles rendements ; le premier 982 - 1 266 kg de grain et 1 806 - 2 834 kg de paille à l'ha ; le second, respectivement : 315-827 et 675 - 2 891 kg à ha.

Les sorghos à grain et le maïs promettent comme fourrages verts ou pour l'ensilage, mais semblent avoir peu de valeur pour le grain.

Le sarrasin ne semble pas promettant.

Les essais de diverses sortes de lin à graine ont montré que les meilleures sont « Montana Common » et « Select Russian ». Les 4 principales sortes ont donné les rendements en graine suivants :

« Montana Common » (C. I. N° 6) . . . . .	636 kg à l'ha
« Select Russian » (North Dakota N° 1 215 ; C. I. N° 3) . . . . .	623 » » »
« Fargo Common » (North N° 1 133 ; C. I. N° 18) . . . . .	617 » » »
« Russian » (North Dakota N° 155 ; C. I. N° 19) . . . . .	586 » » »

En résumé, les sortes de céréales et de lin à graine paraissant les meilleures pour ce district seraient :

*Blés d'automne* : Ghirka - Kharkov — Turkey

*Blés de printemps* : Kubanka — Erivan — Marquis

*Avoines de printemps* : Kherson — Sixty Day — Swedish Select

*Orges de printemps* : White Smyrna — Hannchen

*Lin à graine* : Montana Common — Select Russian.

Le Tableau II résume les données moyennes obtenues à Archer, de l'épiage à la récolte, au cours des 3 années 1913-1915, pour :

7 sortes de blé d'automne

8 sortes d'avoine

16 sortes de blé de printemps

8 sortes d'orge de printemps.

Il faut noter toutefois que les poids moyens de 1 hl de : blé d'automne — blé de printemps — avoine — se rapportent à 2 années seulement.

### 329 - Arrière-effet de quelques fumures chimiques du maïs ; essais à Gwebi, Rhodésie.

— HOLBOROW A. G., dans *The Rhodesia Agricultural Journal*, Vol. XIII, N° 4, pp. 506-511. Salisbury, Rhodésie, Août 1916.

L'exploitation agricole d'essais de Gwebi a commencé, en 1914-1915, des essais de fumure chimique du maïs, afin de déterminer en 1915-1916, au moyen d'une culture de maïs établie ensuite sur les mêmes parcelles, sans fumure, quelle augmentation de rendement produisait le restant de fertilité laissé dans le terrain par la fumure chimique précédente. Le Tableau I résume les résultats obtenus avec les 7 formules de fumure expérimentées.



TABLEAU I. — Résultats obtenus avec les 7 formules de fumure.

Formules de fumure, en kg à l'ha	Résultats de 1914-15, année d'application des engrais à la 1 <sup>re</sup> culture de maïs		Résultats de 1915-16, sans fumure, en utilisant le résidu de la fumure précédente appliquée au maïs		Valeur de l'augmen- tation rendement en grain au cours des 2 années en l'évaluant à 11,12 fr le quintal, pris à l'exploita- tion	Coût à l'ha des diverses fumures appliquées en 1914-1915
	Rende- ment en grain à l'ha	Augmen- tation de rendement à l'ha due à l'arrière- fumure	Rende- ment en grain à l'ha	Augmen- tation de rendement à l'ha due à l'arrière- fumure		
Sans fumure . . . . .	23,10 qx	—	14,47 qx	—	—	—
I. Superphosphate . . . 84	31,64	8,54 qx	19,77	5,30 qx	153,74 fr	35,06 fr
II. Scories Thomas . . . 146	31,45	8,35	21,43	6,96	170,10	32,72
III. Superphosphate . . . 84	32,22	9,12	20,32	5,85	166,46	56,09
Sulfate de potasse . . . 45						
IV. Scories Thomas . . . 168	32,99	9,89	23,09	8,62	205,67	53,76
Sulfate de potasse . . . 34						
V. Sulfate d'ammoniaque 13	38,95	15,85	24,84	10,37	291,37	58,95
Farine de sang . . . 22						
Superphosphate . . . 73						
Sulfate de potasse . . . 22						
VI. Nitrate de soude . . . 13	35,71	12,61	23,01	8,54	235,02	62,07
Farine de sang . . . 17						
Scories Thomas . . . 22						
Sulfate de potasse . . . 19						
VIIa. Nitrate de soude . . 39	36,91	13,81	23,50	9,03	253,98	62,33
Superphosphate . . . 73						
Sulfate de potasse . . . 28						
VIIb. Nitrate de soude . . 56	34,84	11,74	20,52	6,05	197,62	88,81
Superphosphate . . . 84						
Sulfate de potasse . . . 45						
VIIc. Nitrate de soude . . 78	37,21	14,11	22,51	8,04	246,19	124,65
Superphosphate . . . 146						
Sulfate de potasse . . . 56						

Le terrain de l'exploitation de Gwebi employé pour ces essais dérive d'une diorite rouge et possède une fertilité moyenne. La semence de maïs employée dans les deux essais successifs était celle de « Salisbury White » sélectionné. La semaille se fit le 8 décembre, les deux années, sur terrain labouré, roulé et hersé immédiatement avant l'ensemencement, puis sarclé

et houe 2 fois au cours de la saison. Le Tableau II indique les précipitations durant les 2 années d'essai.

TABLEAU II. — *Précipitations durant les 2 années d'essai.*

	1914-15	1915-16
Septembre . . . . .	9,14 mm	7,36 mm
Octobre . . . . .	—	4,82
Novembre . . . . .	54,35	41,14
Décembre . . . . .	289,30	57,40
Janvier . . . . .	180,08	305,81
Février . . . . .	192,53	18,03
Mars . . . . .	64,77	91,18
Avril . . . . .	15,74	39,62
Mai . . . . .	2,03	4,06
	807,94 mm	569,42 mm

Le Tableau III indique en outre les pourcentages d'épis longs de plus de 152 mm obtenus au cours des divers essais de 1915 et de 1916.

TABLEAU III. — *Pourcentages d'épis longs de plus de 152 mm.*

Formules de fumure	1913	1916
Témoin sans engrais . . . . .	51 %	26 %
I . . . . .	70	45
II . . . . .	69	46
III . . . . .	68	38
IV . . . . .	72	51
V . . . . .	78	52
VI . . . . .	74	44
VIIa . . . . .	78	47
VIIb . . . . .	75	43
VIIc . . . . .	78	56

330 - Deux nouvelles sortes de riz remarquables obtenues en Italie : P 7 et P 6. — MAR CARELLI B., dans *Il Giornale di Riscicoltura*, Année VII, N<sup>os</sup> 1-2, pp. 4-10, 2 fig. Vercelli 15-30 Janvier 1917.

Les frères SANCIO, à Casonvecchio (Santhià, province de Novare) ont obtenu de la variété « Chinese originario », actuellement très répandue dans les rizières de la Lombardie et du Piémont, et presque parfaitement acclimatée, des sortes nombreuses, entrées depuis des années dans la grande culture et remarquables par leur productivité et par leur précocité. Les sélectionneurs susdits ont l'habitude d'isoler chaque année plusieurs dizaines de lignées pures (sournises à des essais préalables quant à la vigueur et à la productivité) en semant les grains de chaque panicule en lignes distinctes ; les lignées qui leur paraissent les plus promettantes sont ultérieurement multipliées et essayées dans les conditions de la grande culture. C'est ainsi qu'ils ont pu, par des passages successifs, sélectionner dès 1915 les 2 sortes nouvelles P 7 et P 6, qui représentent un progrès notable vers la production de riz à haut rendement et de qualités marchandes supérieures. Ces sortes sont

déjà sorties de la phase expérimentale, et elles vont entrer définitivement dans celle de la pratique agricole.

Dans le champ d'essai de la Station de riziculture de Vercelli, on les a cultivées pendant les campagnes rizicoles de 1915 et de 1916 ; le Tableau ci-joint rassemble les résultats de ces essais et ceux des observations de laboratoire.

*Résultats de quelques observations sur tiges, panicules et caryopses  
des sortes P 7 et P 6 (moyennes de 2 à 4 observations).*

	« Chinese originario »	« Originario P 7 »	« Originario P 6 »
Longueur des plantes . . . . .	90-110 cm	100-130 cm	80-100 cm
Longueur des panicules . . . . .	18-21 cm	19-23 cm	18-20 cm
Nombre d'épillets par panicule . . . . .	9-12	10-14	9-11
Nombre de caryopses par panicule . . . . .	130-150	150-180	120-140
Nombre de caryopses par litre . . . . .	21 932	16 482	18 851
Poids de 1000 caryopses . . . . .	30,750 g	36,530 g	35,010 g
Poids de 1 litre de paddy . . . . .	675 g	600 g	660 g
Dimensions des caryopses bruts :			
Longueur . . . . .	7,30 mm	8,25 mm (1)	8,67 mm
Diamètre antéro-postérieur . . . . .	3,55 mm	3,78 mm	3,65 mm
Diamètre latéral . . . . .	2,32 mm	2,50 mm	2,48 mm
Rendement en poids au glaçage :			
Type marchand . . . . .	68 %	71 %	70 %
Rebut . . . . .	2,5 %	2 %	2 %
Epoque de maturité . . . . .	20 sept.	15 sept.	20 sept.
Rendement en paddy à l'ha . . . . .	52 qx	51 qx	54 qx

(1) Cette mesure ne tient pas compte des barbes.

Voici les caractères morphologiques et culturaux qui prédominent chez les deux sortes en question :

« ORIGINARIO P 7 ». — Riz à port érigé, avec la partie herbacée fort développée, assez résistante à la verse. Tige longue de 1 à 1,3 m, d'épaisseur notable, à structure compacte et résistante ; feuilles à limbe très développé, vert foncé ; nœuds des tiges fortement accentués, un peu plus clairs que les autres parties vertes ; pouvoir de tallage limité, mais non inférieur à celui des « Originari Precoci ».

Panicule de type épars, à rachis très allongé (19-23 cm), avec des épillets nombreux (10 à 14) et aussi bon nombre de caryopses (150 à 180) rarement sujets à tomber, d'une belle couleur jaune paille, pourvus de glumes robustes, velues, à côtes bien accentuées, munies de poils raides et de barbes rudimentaires.

Ce qui caractérise cette sorte, c'est la grosseur des caryopses, qui donnent à la mensuration : longueur moyenne 8,25 mm — diamètre antéro-postérieur 3,78 mm — diamètre latéral 2,5 mm — poids de 1 000 grains 36,53 g, de beaucoup supérieur au poids atteint jusqu'ici par les meilleures sortes de riz indigènes à gros grain. Son rendement au glaçage est également de beaucoup supérieur.

L'époque de maturité (15 septembre) avance de quelques jours sur celle du « Chinese originario », et le rendement en paddy oscille entre 50 et 52 quintaux à l'ha. Le rendement en paille est également notable, grâce à la longueur de la tige et au développement abondant des feuilles.

C'est une sorte qui se prête bien à la culture en terrains même médiocrement fertiles, car



le fort développement de toutes les parties aériennes que l'on constate dès les premiers moments de vie de la plante, et l'abondance du système radical, assurent une potentialité d'absorption prononcée, et en tout cas proportionnelle aux exigences de la plante.

« ORIGINARIO P 6 ». — Sorte beaucoup moins vigoureuse que la précédente, mais possédant une résistance notable à la verse. Tige ne dépassant pas 80 cm de longueur et relativement mince; feuilles médiocrement développées, de couleur vert-clair, moins abondantes que chez P 7; nœuds des tiges peu marqués, de couleur blanchâtre; pouvoir de tallage pareil à celui du « Chinese originario ».

Panicule ramassé, fortement arqué, avec un rachis de longueur moyenne (18 à 20 cm), des épillets (9 à 11) et des caryopses (120 à 140) médiocrement nombreux; mais plus fertiles que ceux de P 7 (c'est-à-dire ayant moins de glumes vides), ne tombant pas, d'une couleur jaune-paille pâle et à glumes un peu moins épaisses que celles de P 7, et complètement glabres et mutiques.

Les caryopses de cette sorte présentent des dimensions longitudinales même plus grandes, et elles donnent, à la mensuration: longueur moyenne 8,67 mm — diamètre antéro-postérieur 3,65 mm — diamètre latéral 2,48 mm — poids de 1 000 grains 35,01 g. Son rendement au glavage est quelque peu inférieur à celui de P 7, mais le produit à glavage de type marchand présente des grains de qualité plus recherchée, leurs caractères ressemblant à ceux des caryopses des variétés « Ostiglia », « Ranghino », « Nero di Vialone », etc.

L'époque de maturité (20 septembre) coïncide avec celle du « Chinese originario », et le rendement en paddy est légèrement supérieur à celui de cette dernière variété et de P 7, car il oscille entre 54 et 55 quintaux à l'ha.

C'est une sorte un peu exigeante, mais qui s'adapte également bien à des sols compacts argileux et à des sols médiocrement ameublés, pourvu qu'ils soient passablement fertiles et irrigués avec des eaux chaudes.

### 331 - Morphologie et conditions de développement du riz repiqué, en Piémont, Italie. —

MARCARELLI B., dans *Il Giornale di Riscicoltura*, VI<sup>ème</sup> Année, N° 13-14, pp. 211-222; N° 22, pp. 341-347; N° 23, pp. 357-364; N° 24, pp. 372-378, fig. 1-20. Vercelli, 1916.

En vue de montrer les causes spécifiques de la production plus considérable fournie par le riz repiqué en comparaison du riz cultivé suivant les méthodes ordinaires, l'A. étudie les variations apportées par le repiquage au système radical, au tallage et à l'épiage de cette céréale. La variété de riz choisie pour ces recherches est le *Chinese originario*, beaucoup cultivé dans toute la région de Vercelli, vu sa forte productivité et sa facilité d'adaptation au repiquage.

Quelques heures après le repiquage, même si on l'a effectué en terrain recouvert d'eau, une sensible flétrissure de l'extrémité des radicelles commence à se manifester, après quoi il se produit une altération marquée de toute la plante, y compris la partie aérienne. L'arrachage, quoique fait avec soin et dans des conditions de terrain favorables, détruit en effet une grande partie des fines racines qui portent les poils absorbants. Mais la plante réagit immédiatement par une intense et abondante émission de nouvelles racines dans la région du collet et des premiers nœuds, à tel point que, en arrachant avec soin une plantule de riz 3 à 4 jours après le repiquage, on peut constater l'apparition de robustes organes adventices qui, tout en fixant la plante dans le terrain, remplissent directement, grâce aux cellules de leur couche pilifère, les fonctions des radicelles disparues.

Ces racines adventices se forment le long du plan d'insertion de la gaine foliaire, et elles apparaissent pour la plupart dans les nœuds appartenant

*Résultats des essais.*

Système de culture du riz	Essai	Nombre de tiges par plante	Nombre de tiges par m <sup>2</sup>	Longueur des plantes	Longueur des panicules	Nombre d'épillets par panicule	Nombre de caryopses par panicule	Rendement en caryopses par m <sup>2</sup>	Rendement en paille par m <sup>2</sup>	Poids de 1000 caryopses	Rendement au glavage, % en poids	
											Produit marchand	Déchet
Semé à demeure	A	1-3	306	80-85 cm	15-19 cm	6-10	84-149	605 g	560 g	30,065 g	70,8 %	2,3 %
	II	1-2,5	263	75-80	15-20	6-10	78-134	584	502	29,995		
Repiqué	A <sub>1</sub>	2-4,5	312	95-100	18-23	7-11	106-189	816	786	30,325	71,3 %	2,5 %
	B <sub>1</sub>	3-6	278	100-110	18-25	7-13	115-247	852	748	30,760		

à la partie inférieure de la tige qui est précisément destinée à rester immergée dans l'eau. Les jeunes racelles, une fois émises, restent longtemps sans se développer beaucoup, mais, aussitôt que les besoins de la plante en éléments nutritifs exigent une plus grande extension de la surface absorbante des racines, leur développement devient rapide et presque violent. Le repiquage entraîne donc d'une part une réduction très sensible des véritables racines, et, d'autre part, l'émission simultanée et copieuse de racines adventices qui remplacent bientôt les premières dans leurs fonctions, en maintenant intenses et proportionnels à l'activité physiologique de la plante entière les échanges avec le milieu minéral du terrain. Et comme leur étendue plus grande et leur tendance à se maintenir dans les couches superficielles du sol, plus fertiles et dans de meilleures conditions physico-mécaniques, assurent le maximum d'utilisation des éléments fertilisants, on comprend que le riz repiqué se développe d'une façon plus complète et fournisse une production plus abondante. La connaissance des caractères biologiques spéciaux acquis par le riz repiqué, relativement à la croissance herbacée, à l'épiage et à la maturation, est plus intéressante encore que les modifications subies par le système radical. Dès que la plante a repris, il se forme à la base de la tige de nouvelles pousses, ce qui, avec l'extension plus grande de la superficie foliaire, assure un tallage copieux et simultané. Si l'on suit les phases consécutives de l'accroissement des tiges, on observe un certain arrêt dans l'axe principal ; celui-ci, tout d'abord plus haut que tous les autres, est bientôt rejoint par les tiges secondaires incitées, par les conditions spéciales d'espace, d'air et de lumière, à s'étendre et à donner naissance à de larges feuilles d'un vert intense avec des entrenœuds longs et robustes et des nœuds très prononcés ; cet ensemble fait ressortir immédiatement la vigueur plus grande du riz repiqué en comparaison du riz non transplanté. Quant à la date de la maturité, les tiges primaires et secondaires présentent de minimes différences, et l'on élimine ainsi les épiages successifs et très tardifs, qui sont si fréquents dans les conditions ordinaires de culture.



Enfin, les recherches portant sur le produit travaillé montrent que les paddys obtenus de plants repiqués donnent un plus fort rendement en riz glacé que les paddys produits en rizière ensemencée à demeure; donc, à ce point de vue également, les caryopses acquièrent une valeur commerciale appréciable, et leurs caractères extérieurs, leur poids plus élevé, leur rendement plus fort en riz glacé, dénotent leur évidente supériorité au point de vue de la vente (voir le Tableau ci-joint).

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332 — **Multiplication de la pomme de terre au moyen de sa pelure; expériences en Italie.** — CASTALDI G., dans *Società degli Agricoltori italiani, Bollettino quindicinale*, XXII<sup>ème</sup> Année, N° 3, pp. 44-46. Rome, 15 Février 1917.

Au printemps de 1916, l'A. a expérimenté à S. Angelo d'Alife (province de Caserte) la multiplication de la pomme de terre suivant une méthode économique imaginée par lui, à savoir au moyen de la pelure du tubercule découpée en ruban de 2 mm d'épaisseur environ (c'est-à-dire avec un peu de chair adhérente), et avec les yeux. Sur 100 parties en poids de pommes de terre, il obtint ainsi 45,5 parties de pelures pour la plantation, et 54,5 parties de tubercules pouvant être utilisés pour l'alimentation ou par l'industrie. L'essai de culture se fit sur des parcelles carrées, traitées toutes de la même manière pour la préparation du sol et pour la fumure; on y planta alternativement (le 19 mars) dans les unes des pommes de terre entières, dans les autres les pelures de la même sorte. Les travaux de culture, identiques, furent exécutés en même temps sur toutes les parcelles. La récolte se fit le 4 août. Dans les différentes parcelles, la végétation fut uniforme, et les rendements ne présentèrent pas de différences notables. Ils furent, en moyenne, les suivants :

	Reproduction par tubercules entiers	Reproduction par la pelure en ruban
Superficie de chaque parcelle . . . . .	360 m <sup>2</sup>	360 m <sup>2</sup>
Quantité de l'élément utilisé pour la plan- tion . . . . .	54,50 kg	24,57 kg
Tubercules récoltés . . . . .	288 kg	286 kg

Rapportés à l'ha, ces résultats montrent qu'avec 682 kg de pelures on a obtenu 7 944 kg de tubercules, tandis qu'avec 1 513 kg de pommes de terre entières on a obtenu 8 000 kg de tubercules.

333 — **La *Medicago falcata* dans le midi de l'Italie.** — LOPRIORE G., dans *Le Stazioni Sperimentali Italiane*, Vol. XLIX, N° 12, pp. 649-658, 3 fig. Modène, 1916.

La *Medicago falcata*, à fleurs jaunes, spontanée dans toute l'Italie méridionale, où elle pousse un peu partout, envahissant même les terrains cultivés où elle cause des dégâts importants, se distingue par sa grande résistance à la sécheresse, grâce à sa racine pivotante qui pénètre, lorsque le terrain le permet, jusqu'à plusieurs mètres de profondeur.

On a commencé à Cerignola (Pouille) des travaux de sélection visant à choisir et à transplanter les plantes ayant un développement plus vigoureux et un port plus érigé. En effet, abstraction faite du caractère botanique de son fruit recourbé en arc au lieu d'être en spirale comme chez *M. sativa*,

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la *M. falcata* a une tige qui n'est pas complètement érigée, mais plus ou moins inclinée et même rampante sur le sol, et des feuilles plus étroites et plus petites ; aussi ne produit-elle pas une aussi grande masse de fourrage que *M. sativa*.

Les résultats des analyses déjà effectuées permettent toutefois d'espérer en l'avenir de cette luzerne spontanée qui met seule la verdure de sa végétation sur l'aride étendue des chaumes, lorsque, pendant l'été, le « Tavoliere » de la Pouille (1) devient un désert et qu'aucune autre plante ne résiste à l'extrême chaleur.

L'analyse d'un échantillon complètement en fleurs, prélevé à Cerignola le 19 juin 1912, a donné les résultats suivants :

Eau hygroscopique . . . . .	7,36 %
Protéine brute . . . . .	14,00
Matière grasse brute . . . . .	2,33
Cellulose . . . . .	34,60
Cendres . . . . .	8,10
Extractifs non azotés . . . . .	33,61
	100,00

Comme on le voit, la plante est riche en matières nutritives. La protéine atteint le maximum constaté dans les foin de l'Italie méridionale (14—16 %) ; la quantité de cendres et de matières grasses est suffisante, bien qu'un peu inférieure à celle des foin normaux.

Ces données ne concernant qu'un produit spontané, dont aucun soin cultural (labour, fumure, irrigation, etc) n'est venu élever la valeur nutritive, il est permis de croire que, soumise à la culture, cette plante augmenterait sensiblement en valeur.

334 — **Etudes comparatives des divers caoutchoucs d'hévéa des Amazones, Brésil.** — HEIM F., dans *Bulletin de l'Office Colonial*, 9<sup>ème</sup> Année, N° 108, pp. 511-516. Melun, Décembre 1916.

PLANTES  
À CAOUTCHOUC,  
À GOMMES  
ET À RÉSINES

L'intérêt que présentent pour les producteurs de caoutchouc Para de plantation les caractéristiques différentielles des caoutchoucs Para indigènes, a amené l'A. à étudier 6 échantillons de caoutchouc de la catégorie « Corraça fina » provenant de différentes zones des Amazones, afin de voir s'il conviendrait de créer des plantations au moyen de semences fournies par certaines variétés locales d'hévéa des Amazones.

Les échantillons analysés diffèrent de peu entre eux ; ils sont préparés suivant une méthode identique, par fumigation, et ils se présentent sous forme de petites boules recouvertes de pellicules.

On les a classés commercialement sous les noms suivants : N° 1 « Fina das Ihlas » — N° 2 « Fina de Caviana » — N° 3 « Fina de Amapu » — N° 4 « Fina de Cajary » — N° 5 « Fina de Xingu » — N° 6 « Fina de Tapajoz ».

(1) On nomme ainsi la grande plaine, d'altitude moyenne peu supérieure à 70 m, située au nord de la Pouille et dominée par le Mont Gargano, dont elle entoure  $\frac{3}{4}$  du périmètre.  
(N. d. R.)

Les résultats des analyses reproduites par l'A. comprennent, quant à la composition chimique : cendres — eau — matières solubles dans l'eau — résines — matières insolubles dans le chloroforme — matières protéiques — caoutchouc — et, quant à l'analyse industrielle : souplesse — extensibilité — ténacité — nervosité — élasticité — marque différentielle.

Pour en faire une juste interprétation, il faut se rappeler que les échantillons, très probablement, n'avaient pas moins de 1 an de conservation, et qu'ils avaient donc déjà subi un commencement d'altération, inappréciable à l'examen organoleptique, mais que certains indices spéciaux permettaient de reconnaître. Une proportion assez forte de matières restait insoluble dans le chloroforme, ce qui fait supposer qu'une partie du caoutchouc s'était polymérisée. Toutes les variétés examinées ont donné une valeur plutôt basse de propriétés élastiques, ce qui semble être en relation avec l'altération du caoutchouc.

La valeur comparative effective des variétés étudiées, à l'état frais, doit donc être considérée comme supérieure à celle que l'on a trouvée chez les échantillons examinés. La ténacité et l'extensibilité ont une valeur élevée chez tous les échantillons. Si l'on compare les qualités étudiées aux qualités courantes du commerce qui sont bien déterminées, on voit qu'elles se classent bien chez les Para fins assez tendres ; la marque différentielle fait particulièrement ressortir cette conclusion, ainsi qu'on le voit dans le Tableau suivant :

	Sou- plesse	Extensi- bilité	Ténacité	Nervosi- té	Elasti- cité	Marque différen- tielle
Para fin (hard cure) . . . . .	1	1	1	1	1	1
Para fin (soft cure) . . . . .	1	1	1	0,9	1	1
Para fin tendre. . . . .	1,1	1,5	1,2	0,9	1,1	0,9
Moyenne des Para fins étudiés	1,5	1,8	1,3	0,7	0,8	0,6
Para fin assez tendre. . . . .	1,5	1,8	1,0	0,6	1,0	0,6

De l'examen des résultats fournis par ces analyses, l'A. tend à conclure que les propriétés différentielles des caoutchoucs d'hévéa indigènes des diverses zones du Brésil ne sont pas assez marquées pour justifier une préférence en faveur des semences originaires d'une région déterminée, dans la formation des plantations.

ARBORI-  
CULTURE.

335 — **La culture fruitière en Nouvelle-Zélande.** — LONGTON J., dans *The Fruit World*, Vol. XVII, N° 12, p. 384. Melbourne, Décembre 1916.

Jusqu'en 1909 les progrès de la culture fruitière en Nouvelle-Zélande ont été très lents, mais à cette époque a commencé un grand mouvement d'expansion de cette culture dans plusieurs districts ; il s'est accentué au point qu'actuellement les plantations nouvelles atteignent en moyenne 1 200 ha par an. La superficie complantée est d'environ 20 000 ha. La grande masse des plantations commence maintenant à rapporter ; jusqu'ici la production la plus élevée pour une seule saison n'a été que de 67 964 caisses, mais, avec les nouveaux vergers qui vont bientôt produire et l'augmentation de la production, chaque année, on s'attend à disposer pour l'exportation, dans 2 ou 3 ans, d'environ 700 000 hl.

La plupart des vergers récemment plantés sont destinés à fournir des pommes, principalement pour l'exportation. La culture fruitière n'est pas limitée à un seul district. Celui de Nelson vient en première ligne, mais, dans ceux de Central Otago, de Hawke's Bay et d'Auckland, cette culture se développe considérablement. On estime qu'il y aura en 1917 250 000 caisses disponibles pour l'exportation.

Le Gouvernement a fait voter en 1915 une loi frappant les producteurs de fruits d'une taxe de 3,11 fr par ha (1 *shilling* par *acre*) recouvrée par l'Etat, qui la remet à la « New Zealand Fruitgrowers' Federation Ltd », laquelle représente toutes les associations de producteurs de fruits de la Nouvelle-Zélande. On estime que cette taxe produira dès maintenant une somme de 75 660 fr. Le producteur de fruits ne peut bénéficier de cette taxe que s'il est membre d'une association locale.

Trois coopératives d'emballage et de vente sont présentement en activité, et l'on a déjà construit le premier magasin réfrigérant à l'aide d'une somme avancée à cette fin par le Gouvernement.

La Fédération a décidé d'ouvrir une campagne de propagande visant à augmenter la consommation des fruits en Nouvelle-Zélande, où la vente est susceptible d'augmenter beaucoup.

En ce qui concerne l'exportation, on a proposé d'envoyer un représentant étudier les marchés des états de l'est de l'Amérique, et probablement aussi ceux de l'Inde et des Straits Settlements. Les fonds nécessaires à ces recherches seront prélevés sur le produit de la taxe susdite.

336 - Les hybrides producteurs directs dans la région des Côtes-du-Rhône, France en 1916. — DESMOULIN A. et VILLARD V., dans *Le Progrès agricole et viticole*, 34<sup>ème</sup> année, N° 2, pp. 36-42; N° 3, pp. 59-62. Montpellier, 14 et 21 Janvier 1917.

VITICULTURE.

Résultats de la 17<sup>ème</sup> année d'observations d'hybrides producteurs directs (1). En 1916, elles ont porté sur les suivants :

#### I. — VARIÉTÉS DÉJÀ ASSEZ CONNUES.

##### A. — Hybrides producteurs directs noirs :

- 1) De 1<sup>ère</sup> époque : C. 106-46 — C. 202-75 — S. 128 — S. 1000 — S. 2859 — S. 4643.
- 2) De 2<sup>ème</sup> époque : Seibel 1 — S. 2007 — S. 2660 — Berthille-Seyve 618.
- 3) De fin 2<sup>ème</sup> et de 3<sup>ème</sup> époque : C. 7120 — C. 132-11.

##### B. — Hybrides producteurs directs blancs :

- 1) De 1<sup>ère</sup> époque : C. 272-60 — S. 880 — S. 4681 — Berthille-Seyve 450 — Gaillard 157.
- 2) De 3<sup>ème</sup> époque : S. 793 — Castel 13706.

#### II. — VARIÉTÉS OBTENUES PLUS RÉCEMMENT.

##### A. — Hybrides producteurs directs noirs :

- 1) De 1<sup>ère</sup> époque : B. S. 1129 — S. 4589 — S. 4629 — C. 162-97 — Malègue 829-6 — S. 5145 — S. 5163.
- 2) De fin 2<sup>ème</sup> et de 3<sup>ème</sup> époque : B. S. 822 — S. 4271.

##### B. — Hybrides producteurs directs blancs :

- 1) De 1<sup>ère</sup> époque : S. 4638 — S. 4986 — S. 4995 — C. 299-35.
- 2) De 2<sup>ème</sup> époque : S. 4633 — S. 5061 — S. 4762.

(1) Voir B. 1916, N° 762.

(N. d. R.).



Enfin, les AA. donnent la liste suivante des hybrides, suivant l'époque du *débourrement* (observé le 22 avril 1916):

#### I. — VARIÉTÉS A DÉBOURREMENT TARDIF

(qui, au 22 avril, avaient des bourgeons de 0,5 à 1,5 cm de longueur.)

Petit Boué — B. S. 822, 877, 1125, 1134, 1138 — Caille 16 — Castel 19422 — Couderc 151, 156, 503, 106-38, 142-26, 162-5, 162-46, 162-97 — Malègue 469-9, 474-5, 1132-26, 1157-1, 1157-14, 1397-36, 1583-21, 1595-5, 2149-7, 2324-1 — Perbos N 1-46, — Seibel 1-63, 138, 793, 844, 858, 880, 1077, 2653, 2658, 2660, 2666, 2709, 3021, 4153, 4243, 4271, 4459, 4473, 4499, 4587, 4589, 4591, 4603, 4629, 4646, 4662, 4667, 4673, 4681, 4685, 4689, 4696, 4703, 4711, 4716, 4730, 4732, 4737, 4738, 4748, 4762, 4782, 4842, 4852, 4876, 4877, 4954, 4955, 4970, 4986, 4989, 5001, 5061, 5079, 5125, 5145, 5154, 5161, 5178, 5179, 5187, 5191, 5192, 5198, 5204, 5205, 5221, 5243, 5298, 5308, 5312, 5320, 5322, 5329, 5354.

#### II. VARIÉTÉS A DÉBOURREMENT MOYEN

(qui, au 22 avril, avaient des bourgeons de 2 à 3 cm de longueur.)

Baco 1, Maurice Baco — B. S. 450, 872, 1129, 1162, 1886 — Castel 120, 227, 1028, 13706 — Couderc 363 N, 6334, 7120, 28-112, 132-11, 171-56, 202-75, 286-68, 299-35, 337-50 — Gailard 157 — Malègue 71-7, 1055-5, 1647-8, 1897-12, 2045-81 — Péage 5-17 — Perbos N 6-53 — Seibel 73, 82, 128, 2052, 2686, 2821, 4111, 4132, 4595, 4596, 4614, 4615, 4616, 4628, 4632, 4633, 4638, 4648, 4669, 4677, 4684, 4701, 4707, 4709, 4720, 4725, 4749, 4767, 4768, 4825, 4833, 4871, 4910, 4945, 4953, 4976, 4979, 4990, 4994, 4995, 5024, 5033, 5068, 5077, 5090, 5091, 5138, 5163, 5164, 5167, 5175, 5181, 5184, 5207, 5212, 5213, 5230, 5279.

#### III. VARIÉTÉS A DÉBOURREMENT DEMI-HÂTIF

(qui, au 22 avril, avaient des bourgeons de 4 à 5 cm de longueur.)

Capéran — B. S. 618 — Buisson vert — Castel 6011 — Couderc Baronne 4, 106-46, 106-51, 226-58, 272-60 — Jurie 102 — Malègue 829-6 — Seibel 1000, 2006, 2806, 2859, 4151, 4461, 4636, 4643, 4645, 4656, 4657, 4683, 4773, 4968, 4991, 4999, 5170, 5233, 5259, 5409.

#### IV. VARIÉTÉS A DÉBOURREMENT HÂTIF OU PRÉCOCE

(qui, au 22 avril, avaient des bourgeons de plus de 5 cm de longueur.)

Couderc 235-120 — Péage 5-10, 1-4 — Seibel 867, 2007, 4644, 4963, 4964, 4969, 5140.

SYLVICULTURE

337 — **Résinage d'épicéas, de pins sylvestres et de pins noirs dans les forêts domaniales d'Autriche (1) ; résultats obtenus en 1916.** — FRIEDRICH ERNST, dans *Oesterreichische Forst- und Jagd-Zeitung*, 25<sup>ème</sup> Année, N° 6, pp. 31-33. Vienne, 9 Février 1917.

En vue d'obtenir, dans le pays même, la résine brute nécessaire à l'industrie et à l'armée, la Direction impériale et royale des Forêts et Domaines, à Vienne, a fait recueillir en 1916 tout d'abord de la résine d'épicéa provenant de blessures d'arbres faites dans des coupes ou par le gibier de montagne, de souches, etc., et en a obtenu de cette façon 1 700 quintaux métriques. La récolte fut faite par des écoliers, des femmes, etc, avec des frais et des résultats très divers suivant les localités. En outre, l'Administration prit des mesures visant bien moins aux résultats lucratifs qu'à l'accroissement de

(1) Au sujet du résinage en Autriche, voir aussi B. 1915, N° 62.

(N. d. R.)

la production de résine, à savoir : 1) résinage de vieux peuplements d'épicéa à exploiter les années suivantes ; 2) résinage de pins sylvestres suivant le système de KIENITZ ; 3) introduction du procédé français de gemmage avec arçipients dans des peuplements de pins noirs (*Pinus austriaca*).

ÉPICÉAS. — Par suite de pénurie de main-d'œuvre, le gemmage des vieux peuplements ne put se faire au début que dans 3 administrations forestières de l'Erzgebirge. Les arbres à exploiter en 1916 ne furent gemmés qu'au pied, pour sauvegarder la récolte d'écorce, tandis que les arbres à exploiter en 1917 et 1918 furent gemmés jusqu'à hauteur d'homme. Le raclage de la résine écoulée s'opéra en automne et donna en moyenne 0,05 kg de produit par mètre cube, au lieu de 0,2 kg qu'on en attendait. L'opération, faite sur 45 000 arbres, donna un rendement de 22,5 quintaux. Le gemmage se fit à la journée et la récolte de la résine à la tâche. Le prix de revient, y compris l'emballage et le transport aux gares, fut de 4 821,34 *couronnes* (1) au total, soit de 2,14 *couronnes* par kg. Les 22,5 quintaux de résine ayant rapporté 2 257 *couronnes*, l'opération solda par un déficit de 2 293,5 *couronnes*, correspondant à 1,01 *couronne* par kg en moyenne.

Selon l'A., le faible rendement en résine serait dû à la température fraîche et pluvieuse de l'été de 1916, qui en entrava l'écoulement, et aussi au fait que le raclage de la résine s'effectua 6 mois après le gemmage. Le résultat financier désavantageux est imputable en particulier à l'élévation des salaires, mais l'opération pourra être plus profitable ces prochaines années, car il ne sera pas nécessaire de pratiquer de nouvelles incisions, et l'on peut s'attendre à un léger bénéfice pour 1917, même en n'admettant qu'un rendement de 0,1 kg de résine par arbre.

PINS SYLVESTRES. — Le résinage suivant le système KIENITZ se fit sur 4 073 arbres mesurant en moyenne 28 cm de diamètre à hauteur d'homme, dont chacun reçut 3 entailles. Divers motifs ne permirent de commencer le résinage que le 18 juin, et il dura jusqu'au 15 novembre : la récolte de gemme (résine fluide) se fit du 18 juin au 14 octobre et celle de barras (résine solidifiée sur le bois) s'opéra du 14 octobre au 15 novembre, sur 2 370 arbres seulement.

On obtint 1 425 kg de gemme et 208 kg de barras. En évaluant la première à 150 *couronnes* par quintal et le second à 110 *couronnes*, on obtient pour les 1 633 kg totaux de résine une valeur de 2 366,3 *couronnes*. Le prix de revient étant évalué par l'A. à 3 094 *couronnes*, l'opération solde par un déficit de 727,7 *couronnes*.

Ce mauvais résultat financier est imputable au début tardif de la récolte, aux mauvaises conditions atmosphériques, aux salaires élevés, aux gros frais de transport et, pour une bonne part aussi, au manque d'expérience des ouvriers. Là aussi, divers motifs permettent d'espérer pour l'an prochain un meilleur résultat.

PINS NOIRS. — On se proposait de pratiquer le résinage suivant le procédé français sur une superficie de 89,2 ha, ayant une densité moyenne

(1) 1 *couronne* or = 1,05 fr au pair.

(N. d. R.)

de 770 pieds par ha et censée contenir en tout 13 500 pieds. On dressa le devis suivant :

RENDEMENT BRUT:		COURONNES
10 800 kg de barras à 65 couronnes le quintal . . . . .	7 020	
43 200 kg de gemme à 105 couronnes le quintal . . . . .	45 360	
		52 380,00 couronnes
DÉPENSES:		
Récolte . . . . .	22 080	
Transport à la gare . . . . .	1 620	
Achats de matériel pour le résinage (portés en compte désà la 1 <sup>re</sup> année) . . . . .	6 448,10	
Frais divers . . . . .	2 000	
		32 148,10 couronnes
Rendement net . . . . .	20 231,90	couronnes

En se basant sur ce devis on entreprit le résinage, mais on reconnut bientôt que le résultat serait inférieur aux prévisions, et cela pour des motifs très divers : Tout d'abord, on ne put obtenir les ouvriers nécessaires ; ensuite les récipients (godets) ne purent être acquis en temps voulu, et comme ils ne mesuraient que 0,5 litre, au lieu de 1 litre comme il aurait fallu, il en résulta un important surcroît de besogne. Les salaires se trouvèrent aussi supérieurs à ce qu'on avait admis. Le résinage ne put débiter que le 17 juillet et ne put se faire que sur 6 000 arbres, au lieu des 13 500 du devis.

Comme on avait laissé passer la meilleure époque d'écoulement de la résine, le rendement fut très faible : en tout 5 028 kg, dont 4 377 kg (87 %) recueillis dans les godets et 651 kg (13 %) provenant du raclage, soit, en moyenne, 0,83 kg par arbre. Des sujets d'essai, traités du 1<sup>er</sup> mai au 25 octobre régulièrement tous les 3 à 4 jours suivant les conditions atmosphériques, donnèrent en moyenne 4,45 kg de résine l'un. Le résultat financier de ce genre de résinage fut naturellement très mauvais et ne correspondit aucunement à celui du devis.

Malgré l'insuccès relatif de ces essais, l'A. conseille de ne pas abandonner le résinage, mais au contraire de le soumettre à de nouveaux essais.

338 — Les forêts de protection et leur influence sur le régime des pluies et des cours d'eau, dans l'Inde britannique. — Voir N° 304 de ce Bulletin

339 — Boisement des dunes dans la province de Cadix, Espagne. — Voir N° 309 de ce Bulletin.



## PRODUCTION ANIMALE.

340 - L'ingestion de bacilles de la morve tués détermine-t-elle, dans le sang des chevaux, la formation d'anticorps spécifiques ? — LANGE W., dans *Deutsche Tierärztliche Wochenschrift*, 24<sup>ème</sup> Année, N° 45, pp. 407-408. Hanovre, 4 Novembre 1916.

HYGIÈNE  
DU BÉTAIL.

En vue de résoudre cette question, l'A. a administré à un cheval sain, pendant 2 semaines, de fortes doses de bacilles de la morve tués ; l'animal recevait chaque jour, avec l'eau d'abreuvement, un demi-litre de cultures de bacilles de 5 souches diverses, bien développées, âgées de 2 jours, et tuées par un chauffage de 2 heures à 60° C. La dose tout entière était régulièrement bien acceptée par l'animal. Avant, pendant et 4 semaines après l'expérience, l'A. a examiné le sang du cheval à intervalles de quelques jours au moyen de la méthode d'agglutination et de la méthode de fixation de complément. Dans plusieurs cas il a pratiqué aussi l'examen des yeux du cheval.

*Résultats* : Pendant toute la durée de l'essai, il n'y a pas eu d'augmentation des valeurs d'agglutination ; la méthode de fixation de complément a toujours donné un résultat négatif ; de même l'examen des yeux du cheval. Il en résulte que l'ingestion de fortes doses de bacilles de la morve tués n'a pas réussi à provoquer, dans le sang de ce cheval, la formation d'anticorps spécifiques décelables.

341 - Dommages causés au bétail en pâture par le moustique *Simulium reptans*, en Allemagne. — MATTHIEN ET BEUTLER, dans *Berliner Tierärztliche Wochenschrift*, 32<sup>ème</sup> Année, N° 32, pp. 373-377. Berlin, 10 Août 1916.

Le moustique *Simulium reptans*, commun dans les bas-fonds des rivières Leine et Aller (Prusse), a fait en 1916, comme les années précédentes (1), de nombreuses victimes parmi le bétail au pâturage. La température de l'air, qui était relativement basse jusqu'au 20 avril, s'éleva peu à peu, permettant ainsi aux moustiques d'apparaître en masse et d'infecter les bovins, parfois même les chevaux.

Les AA. se rendirent immédiatement (le 23 avril) dans le district de Neustadt pour étudier la maladie. Ils purent, non seulement observer un grand nombre d'animaux malades ou morts, mais aussi, fort souvent, déterminer la situation des pâturages infestés et l'époque de l'apparition de la maladie chez les animaux. A cette occasion ils trouvèrent les nymphes de *Simulium* dans l'eau courante, même dans les pâturages jusqu'ici restés indemnes.

En observant attentivement les hémorragies de la peau chez les animaux morts, on remarquait au milieu un point noir représentant le canal de la piqûre. Le muscle cardiaque, finement effilé sous le microscope, montrait des capillaires fortement remplis de sang et des raies transversales très nettes. L'examen bactériologique du sang du cœur, des glandes lymphatiques et de parties de la rate, donna en général un résultat négatif. On ne trouva que quelques bâtonnets ressemblant au *B. coli*, mais qui

(1) Voir B., 1915, N° 1173.

(N. d. R.).

étaient probablement entrés dans le corps après la mort des animaux. Les souris vaccinées avec les matières examinées restèrent en vie.

Les symptômes de la maladie apparaissent souvent très vite, souvent aussi quelques heures seulement après la piqûre ; l'époque de l'apparition dépend probablement de la quantité de venin introduite dans le corps. La mort ou la guérison peuvent se produire à des époques très différentes, quelquefois plusieurs jours seulement après la piqûre.

Chez les bovins, les endroits préférés par le moustique pour la piqûre (mamelle, scrotum, flancs, partie inférieure des cuisses postérieures) n'étaient jamais enflés, mais les glandes lymphatiques correspondantes l'étaient assez souvent. Les enflures sous la gorge et au cou résultent de la faiblesse du cœur occasionnée par l'empoisonnement, faiblesse qui influence également plus ou moins le cerveau. En se couchant, les animaux malades prenaient souvent des positions pareilles à celles des vaches atteintes de parésie vitulaire, probablement par le fait que le cerveau n'était pas assez approvisionné de sang. Ils mangeaient et digéraient difficilement, accusant une paresse dans les mouvements péristaltiques, mais il n'y eut aucun cas de fièvre ;  $\frac{2}{3}$  de ces animaux malades succombèrent.

Il est probable que les animaux mis depuis assez longtemps au pâturage sont moins susceptibles aux piqûres.

Les instructions données jusqu'ici chaque printemps par la police au sujet de la surveillance du bétail dans les districts menacés par les *Simulium* et au sujet de la stabulation à effectuer immédiatement après leur apparition en masse ne suffirent pas, en 1916, à empêcher de grosses pertes de bétail. Par contre, on obtint de bons résultats en appliquant une ordonnance de police publiée à la fin d'avril, laquelle ne permettait de faire pâturer le bétail dans les districts menacés, avant le 15 mai, que par les jours froids et pluvieux, et seulement la nuit (de 22 h à 5 h) quand il faisait beau temps. Non moins efficace fut la circulaire officielle distribuée avant l'expiration de ladite ordonnance et recommandant aux éleveurs, comme mesure de précaution, de ne pas faire pâturer leur bétail par les jours chauds encore pendant quelque temps après le 15 mai.

Pour 1917, les AA. recommandent de réglementer la pâture comme en 1916, mais en prolongeant la période où elle est interdite pendant le jour, de façon que cette période dure du 1<sup>er</sup> avril au 1<sup>er</sup> juin.

342 - Contribution à la connaissance du strongylyde *Syngamus bronchialis* chez la volaille domestique. — FEUEREISSEN, W., dans *Zeitschrift für Fleisch- und Milchhygiene*, 27<sup>ème</sup> Année, Fasc. 2, pp. 17-22. Berlin, 15 Octobre 1916.

Tandis que l'on a beaucoup publié au sujet du strongylyde *Syngamus trachealis*, fréquent dans le larynx et la trachée de la volaille domestique, on connaît encore très peu l'espèce affine *Syngamus bronchialis*. Elle a été décrite exactement pour la première fois par MÜHLIG, mais on en a si peu parlé depuis que l'A. a jugé bon de la soumettre à de nouvelles recherches.

Il a d'abord étudié le cadavre d'un oison provenant d'un troupeau de 25 de ces animaux qui étaient tous tombés malades après avoir été plusieurs fois dans un étang fangeux, et dont une grande partie avaient succombé, en manifestant : asthme, manque d'appétit et faiblesse.



En pratiquant l'autopsie de cet oison, l'A. trouva 72 strongylides dans la trachée et les bronches. La trachée contenait 11 vers rougeâtres assez grands, tandis que les bronches renfermaient de nombreux nématodes, d'aspect analogue, mais de couleur blanchâtre, qui s'étaient introduits même dans les plus fines bronchioles. Les premiers étaient attachés par la tête à la muqueuse de la trachée, mais ils s'en laissaient facilement détacher ; par contre, la plupart des seconds n'étaient pas attachés aux bronches. Environ  $\frac{1}{3}$  de ces parasites étaient à l'état de copulation, moins étroite que chez *S. trachealis*. L'exacte description zoologique de MÜHLIG est en général confirmée par les observations de l'A., sauf que celui-ci a vu des vers un peu plus grands.

Chez un 2<sup>ème</sup> oison étudié par l'A., la trachée et les poumons étaient exempts de strongylides. Il convient de remarquer à cet égard que, au moment de l'autopsie, le cadavre était déjà presque complètement décomposé et envahis par des larves de mouches. La partie droite du sac aérien abdominal de l'animal était cependant gonflée par un exsudat caséeux contenant de nombreux fragments et œufs de strongylides. Il s'agit donc d'un cas où l'animal avait succombé ultérieurement à l'épuisement produit par la maladie. La présence de fragments et d'œufs de vers dans le sac aérien abdominal montre que ces strongylides entrent même dans les cellules aériennes, ce qui doit être pris en considération lors de l'autopsie de la volaille.

Comme pour *S. trachealis*, le cycle d'évolution de *S. bronchialis* n'est pas encore connu, ce qui empêche de combattre efficacement la maladie provoquée par ce parasite.

343 - **Teneur en iode des aliments du bétail.** — BOHN RALPH M. (Laboratoire de Chimie agricole de l'Université du Wisconsin, Madison), dans *The Journal of Biological Chemistry*, Vol. XXVIII, N° 2, pp. 375-381. Baltimore, Md., Janvier 1917.

ALIMENTATION  
DU BÉTAIL.

On a beaucoup étudié le rapport entre l'iode et le métabolisme thyroïde, mais, avant les recherches de FORBES et BEEGLE (*Ohio Agricultural Experiment Station, Bulletin* 299, 1916), on n'avait fait aucune recherche méthodique sur l'iode que peuvent fournir les matières alimentaires. Les résultats obtenus par l'A. s'accordent avec les données de ces deux savants.

Il a comparé 3 méthodes pour la détermination de l'iode dans les matières organiques, celles de KRAUSS, de HUNTER et de KENDALL, et il a trouvé que celle de KENDALL est de beaucoup la plus exacte.

Les aliments suivants ont fourni des résultats excluant qu'il y ait plus de 0,0015 mg. d'iode par gramme de produit examiné : farine de maïs — « tankage » (farine de résidus d'abattoirs) — déchets de viande du commerce — foin de trèfle — luzerne — choux — avoine concassée — farine d'avoine — avoine en fleur — avoine très jeune — foin de fléole — farine de blé — betterave sucrière — lait en poudre — tourteaux oléagineux — drèches de distillerie — gluten de blé — paille d'avoine — paille de blé — colza — farine de graines de coton — pois — fanes de pois — luzerne du Kansas.

Les germes de blé, l'orge, le mélilot et le foin de prairie du Kansas ont parfois accusé des traces d'iode, mais ne dépassant certainement pas 0,0025 mg par gramme de produit examiné.



Le gluten de maïs, la pomme de terre, la laitue et les deux eaux naturelles examinées ont accusé des traces distinctes d'iode allant de 0,0015 à 0,005 mg par gramme de produit ou comprises entre 0,003 et 0,01 mg par litre d'eau.

Des échantillons de sel gemme pour bétail provenant de diverses mines des Etats-Unis n'ont jamais accusé la moindre trace d'iode.

Il semble que la présence de l'iode dans les matières alimentaires d'origine végétale soit purement accidentelle et ne conserve pas une fonction nutritive nécessaire chez la plante. D'autre part, l'iode nécessaire aux animaux doit forcément leur être fourni par les traces qui s'en présentent dans les produits végétaux, les eaux, etc.

## REPRODUCTION

344 - **Les mamelles rudimentaires chez le porc, caractère limité au sexe.** — WENTWORTH EDWARD N. (Paper N° 2 from the Laboratory of Animal Technology, Kansas Agricultural Experiment Station), dans *Science*, New Series, Vol. XLIII, N° 1114, p. 648. Garrison-on-Hudson, N. Y., 5 Mai 1916.

L'hérédité des mamelles rudimentaires existant : chez le *verrat* sur la partie inférieure du scrotum ; chez la *truie* en arrière de la dernière paire de mamelles inguinales, entre les cuisses, a été décrite par l'A., en 1912 et 1913, comme typiquement limitée au sexe (« sex-limited »). Ensuite, en 1914, comme on n'avait pas réussi à trouver un verrot homozygote quant à ce caractère, on tenta de classer cette hérédité comme de nature « liée au sexe » (« sex-linked »). Quelques découvertes plus récentes, dues en partie à un petit nombre d'accouplements choisis, ont éliminé les difficultés à l'existence desquelles on avait cru en 1914, et rendu plus probable l'interprétation primitive.

Voici le cas en question : un verrot Duroc-Jersey pourvu de mamelles rudimentaires fut accouplé à une truie noire qui n'en possédait pas. Celle-ci eut une portée de 9 petits : 4 mâles et 1 femelle pourvus de mamelles rudimentaires ; 1 mâle et 3 femelles qui en étaient privés. Ce résultat, joint aux essais publiés auparavant relativement à l'hérédité de ce caractère, indique que le verrot Duroc-Jersey et la truie noire étaient tous deux hétérozygotes quant à ce caractère.

Un des verrats de la portée pourvus de mamelles rudimentaires fut accouplé aux 4 truies de la même portée, et donna les résultats suivants :

Numéro d'enregistrement	Constitution héréditaire apparente	Mâles		Femelles	
		Avec mamelles rudimentaires	Sans mamelles rudimentaires	Avec mamelles rudimentaires	Sans mamelles rudimentaires
Truie 26	RR	4	0	3	0
Truie 27	Rr	4	0	3	2
Truie 28	rr	3	0	0	2
Truie 29	rr	4	0	0	4

Ces résultats indiquent définitivement que le verrat avec lequel on avait commencé l'expérience était homozygote quant aux mamelles rudimentaires. Tous les verrats issus de lui possédaient ce caractère, bien que 2 des truies appartenissent au type qui ne le transmet pas. S'il avait été hétérozygote pour ce caractère, une partie au moins des 7 mâles produits par les truies Nos 28 et 29 auraient dû perdre les mamelles rudimentaires, car la probabilité de les posséder aurait été pour eux de 1 sur 128. La découverte d'un verrat homozygote quant aux mamelles rudimentaires élimine la principale objection contre la simple théorie du caractère limité au sexe, énoncée par WOOD.

345 — **Données statistiques relatives à l'âge des taureaux et des vaches destinés à la reproduction dans le Maine, Etats-Unis.** — PEARL RAYMOND, dans *Maine Agricultural Experiment Station, Report of Progress on Animal Husbandry Investigations in 1915*, N° 519-12-15, pp. 19-22. Orono, Maine, 1916.

L'âge des taureaux et des vaches destinés à la reproduction constitue un facteur important dans nombre de problèmes de zootechnie.

On connaît l'influence de l'âge sur la production des vaches laitières, et la limite économique convenable à ce sujet peut être précisée avec une exactitude suffisante. Mais le problème de l'âge a une importance spéciale dans la pratique de la sélection des vaches à lait. Le travail de sélection est basé principalement sur l'étude des résultats obtenus dans la descendance, mais, dans la pratique, le principe n'est pas appliqué si un reproducteur donné est éliminé du troupeau avant que sa descendance ait été contrôlée quant à la production laitière.

TABLEAU I. — *Age des reproducteurs.*

Age en années	a) Taureaux reproducteurs		b) Vaches primipares ou multipares		c) Génisses saillies pour la 1ère fois		d) Ensemble des femelles (b+c)	
	Fréquence absolue	%	Fréquence absolue	%	Fréquence absolue	%	Fréquence absolue	%
1	213	22,03	4	0,56	69	41,57	73	8,31
2	252	26,06	83	11,66	92	55,42	173	19,93
3	209	21,61	138	19,38	5	3,01	143	16,29
4	149	15,41	101	14,19	—	—	101	11,50
5	52	5,78	80	11,24	—	—	80	9,11
6	53	5,48	69	9,69	—	—	69	7,86
7	24	2,48	66	9,27	—	—	66	7,52
8	8	0,83	44	6,18	—	—	44	5,01
9	3	0,31	44	6,18	—	—	44	5,01
10	—	—	33	4,63	—	—	33	3,76
11	—	—	22	3,09	—	—	22	2,51
12	4	0,41	13	1,83	—	—	13	1,48
13	—	—	9	1,26	—	—	9	1,03
14	—	—	—	—	—	—	—	—
15	—	—	2	0,28	—	—	2	0,23
16	—	—	2	0,28	—	—	2	0,23
17	—	—	1	0,14	—	—	1	0,11
18	—	—	1	0,14	—	—	1	0,11
Totaux	967	100	712	100	166	100	878	100

Ces considérations ont amené l'A. à recueillir, chez les éleveurs les plus notables du Maine, des données statistiques sur l'âge des reproducteurs; réunies dans le Tableau I, elles se rapportent aux mises-bas escomptées à l'époque de l'accouplement dont elles résultent.

Les principales constantes biométriques déduites du Tableau I sont rassemblées dans le Tableau II.

TABLEAU II. — *Constantes biométriques.*

Constantes	a) Taureaux reproducteurs	b) Vaches primipares ou multipares	c) Génisses saillies pour la 1 <sup>re</sup> fois	d) Ensemble des femelles (b + c)
Age moyen (Average age) . . .	2,921 ± 0,037 ans	5,553 ± 0,075 ans	1,614 ± 0,024 ans	4,809 ± 0,070 ans
Age médian (Median age) . . .	2,589 ± 0,047 ans	4,875 ± 0,093 ans	1,652 ± 0,030 ans	3,975 ± 0,087 ans
$\frac{3}{4}$ de l'âge complet (Third quartile age) . . . . .	3,844 ± 0,047 ans	7,242 ± 0,093 ans	2,103 ± 0,030 ans	6,765 ± 0,087 ans
Écart d'avec la moyenne (Standard deviation) . . . . .	1,722 ± 0,026 ans	2,952 ± 0,053 ans	0,462 ± 0,017 ans	3,080 ± 0,050 ans
Coefficient de variation (Coefficient of variation) . . . .	58,94 ± 1,18 %	53,16 ± 1,19 %	28,64 ± 1,14 %	64,05 ± 1,39 %

Ces données présentent un intérêt particulier pour l'éleveur et le sélectionneur de bétail:

L'âge moyen des taureaux reproducteurs, chez les 967 descendants compris dans la statistique, est de peu inférieur à 3 ans. L'âge médian de ces taureaux est d'environ 2  $\frac{1}{2}$  ans, ce qui indique que 50 % des descendants proviennent de taureaux ayant moins de 2  $\frac{1}{2}$  ans; 75 % de tous les descendants ( $\frac{3}{4}$  de l'âge complet) proviennent de taureaux ayant moins de 3  $\frac{3}{4}$  ans à l'époque de l'accouplement. Moins de 15 % des descendants tirent leur origine de taureaux ayant plus de 5 ans.

L'importance de cette constatation ne peut échapper aux éleveurs. Un taureau doit avoir au moins 3 ans de permanence dans le troupeau pour qu'il ait été possible à l'éleveur et au sélectionneur d'examiner la capacité productive en lait de ses descendants; 58,9 % des descendants examinés proviennent au contraire de taureaux ayant moins de 3 ans.

Pour plus de la moitié des animaux reproducteurs examinés il y a donc impossibilité matérielle, de la part des sélectionneurs, de connaître l'aptitude des taureaux reproducteurs à transmettre héréditairement la capacité productive. Si ce fait, comme on peut le présumer, se produit aussi chez les autres éleveurs, cela explique en bonne partie la lenteur des progrès dans la sélection du bétail laitier.

En ce qui concerne les femelles, les conditions d'élevage sont meilleures. Si l'on exclut en effet les génisses couvertes pour la première fois, l'âge moyen des vaches de reproduction est de 5  $\frac{1}{2}$  ans environ. C'est déjà un âge auquel les vaches à lait, si elles n'ont pas encore atteint le maximum de leur courbe de production, s'en rapprochent du moins beaucoup.

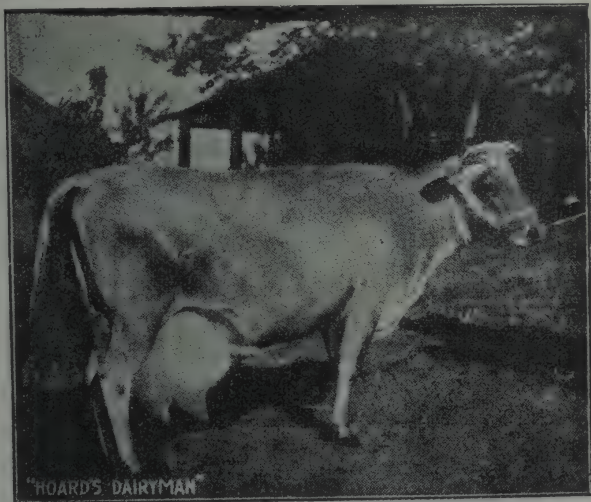
Sur 878 descendants, 166, soit 18,9 %, venaient de la première mise-bas de génisses. L'âge moyen de saillie féconde de ces génisses est de 1 an et 7 mois;  $\frac{3}{4}$  du nombre total des génisses furent fécondées avant d'atteindre l'âge de 2  $\frac{1}{2}$  ans.



## 346 - Vache de race Jersey rapportant 1900 francs par an, dans l'Orégon, Etats-Unis. —

*Hoard's Dairyman*, Vol. LII, N° 20, p. 690. Fort Atkinson, Wisconsin, 8 Décembre 1916.

La vache représentée ici : *Melia's Laune of Alba*, âgée de 8 ans, produit annuellement jusqu'à 15 921 *pounds* (7 222 kg) de lait contenant 841 *pounds* (381 kg) de matière grasse, et rapporte à son propriétaire : M. R. S. SANFORD, la jolie somme de 367 *dollars* (1 902 fr) par an. Sa nombreuse descendance suit ses traces.



La vache *Melia's Laune of Alba*.

## 347 - Influence de l'alimentation sur-normale et sous-normale sur la composition du lait et de sa matière grasse chez la vache ; recherches aux Etats-Unis. — I. ECKLES

C. H. et PALMER L. S., Influence de la sur-alimentation, dans *University of Missouri, College of Agriculture, Agricultural Experiment Station, Research Bulletin* N° 24, 39 pp., 8 + IV tableaux, 4 fig., Columbia, Missouri, Mai 1916. — II. IDEM, Influence de la sous-alimentation. *Ibidem*, N° 25, 107 pp., 26 + XI tableaux, 15 fig. Novembre, 1916.

Durant la période de lactation d'une vache laitière, l'alimentation normale se compose, comme on le sait, de 2 éléments bien distincts : 1) la ration d'entretien ; 2) la ration de production laitière. Suivant que la distribution d'aliments est inférieure ou supérieure à celle qui est requise pour cette alimentation normale, la ration est « sous-normale » ou bien « sur-normale ». Les AA. se proposaient d'étudier expérimentalement l'action de ces deux rations sur l'animal soumis à ces régimes, et principalement sur la composition du lait et de sa matière grasse.

I. — INFLUENCE DE L'ALIMENTATION SUR-NORMALE. — Les expériences relatives à l'influence exercée par la sur-alimentation des vaches durant la période de lactation comprenaient 2 séries : 1) Ration normale, puis ration sur-normale ; 2) Ration sous-normale, puis ration sur-normale. Dans les 2 séries, on observait : 1) le poids de l'animal ; 2) la quantité de

lait produite ; 3) la composition centésimale des composants du lait ; 4) les constantes physiques et chimiques de la matière grasse du lait.

Voici les principaux faits mis en lumière par ces observations :

Dans les 2 séries d'expériences, la sur-alimentation a produit une augmentation de poids et n'a eu aucune influence sur la composition normale du lait et sur les constantes physiques et chimiques de sa matière grasse. Les effets bienfaisants de la sur-alimentation se sont surtout manifestés dans la 2<sup>ème</sup> série d'expériences où, au début, la composition du lait et les constantes de sa matière grasse étaient anormales, par suite de l'alimentation sous-normale qui avait précédé l'alimentation sur-normale. Dans chaque cas, la sur-alimentation a ramené la composition anormale à une composition normale.

Ces résultats semblent amener à conclure qu'il faut s'attendre à une composition normale du lait et du beurre, tant lorsque l'animal reçoit une ration normale que lorsqu'il est soumis à une alimentation sur-normale.

Les résultats de la sur-alimentation sur la quantité de lait produite sont spécialement dignes de remarque. Dans quelques cas seulement, la ration sur-normale a augmenté la production, et d'une façon très limitée. Il s'agit des cas où la production normale de lait avait été réduite par l'effet de la ration sous-normale qui avait précédé la ration sur-normale.

Les physiologistes admettent généralement que le phénomène de la sécrétion lactée est dû à un stimulant chimique ou « hormone » transporté par le sang, et l'on a aussi démontré que la sécrétion lactée est réglée par le système nerveux central, soit au moyen de nerfs sécréteurs, soit au moyen de fibres vasomotrices. Les résultats de ces expériences de sur-alimentation indiqueraient que la sécrétion lactée est réglée au moins par 2 facteurs : l'un chimique et l'autre nerveux ; et que le stimulant chimique prédomine immédiatement après la parturition et détermine la production maximum pour chaque individu, car il est plus ou moins fixe pour chaque individu, et il présente un caractère à la fois héréditaire et physiologique. Le stimulant chimique de la production laitière, imprimé par la parturition, est plus ou moins indépendant du régime alimentaire de l'animal, car les essais de sur-alimentation ne sont pas arrivés à augmenter le stimulant chimique, pour la production du lait, pendant la 1<sup>ère</sup> période de lactation succédant immédiatement à la parturition.

A mesure que la période de lactation avance, le stimulant chimique est graduellement remplacé par un stimulant d'un caractère tout à fait différent, qui a été nommé « stimulant nerveux », et qui dépend entièrement du régime alimentaire. Quand le stimulant nerveux prédomine durant la sécrétion lactée, c'est l'influence de l'alimentation qui prédomine, dans le sens que la diminution de production, due éventuellement à une sous-alimentation, peut être réparée, et la production peut être ramenée au niveau primitif moyennant une augmentation dans la ration, c'est-à-dire grâce à une alimentation sur-normale.

II. — INFLUENCE DE L'ALIMENTATION SOUS-NORMALE. — Cette alimentation fut, comme la précédente, étudiée uniquement au point de vue quantitatif. Le point de vue qualitatif (protéines, hydrates de carbone,



matières grasses considérés isolément) sera étudié dans des expériences ultérieures. Les expériences effectuées ont duré de 7 à 36 jours, et la sous-alimentation a varié entre 15 et 70 % de l'alimentation normale.

Les facteurs qui influent le plus sur les effets de la sous-alimentation sont : stade de la période de lactation — degré de sous-alimentation — caractère de la ration — état de chair de l'animal — régime précédant la sous-alimentation — durée de la sous-alimentation.

La sous-alimentation produit toujours une perte de poids de l'animal en lactation, plus ou moins forte suivant que d'autres facteurs y agissent plus ou moins. L'action qu'elle exerce sur la production de lait varie en fonction de sa durée et du stade de lactation. Aussitôt après la parturition, son action est très limitée. Les vaches ont maintenu leur production de lait à un niveau presque constant, pendant la 1<sup>re</sup> période, immédiatement après la parturition, même dans les conditions de nutrition les plus contraires. Dans l'un des essais, on a eu une production constante pendant 30 jours, avec une ration juste suffisante pour nourrir l'animal. Quand, dans la période de lactation, on a atteint un certain stade, même une sous-alimentation modérée donne lieu à une diminution de la production laitière. Le point exact de la courbe de production où se produit ce phénomène n'a pas été déterminé. Les AA. expliquent cette différence d'effet sur la production laitière en invoquant, comme ils l'ont fait dans les expériences de sur-alimentation, l'effet de 2 facteurs : l'un chimique, l'autre nerveux. La sous-alimentation physiologique (qui se produit naturellement surtout après la parturition chez des animaux bien en chair, ayant un fort stimulant pour la sécrétion lactée) et la réduction d'une sur-alimentation à une alimentation normale sont constamment accompagnées d'une augmentation marquée du taux de matière grasse dans le lait et, d'une façon particulière, lorsque l'animal possède une réserve excessive de graisse dans ses tissus.

En cas de sous-alimentation physiologique, il y a presque toujours une augmentation de la quantité absolue de graisse en même temps qu'une augmentation du taux de matière grasse dans le lait.

En cas de sous-alimentation provoquée, le taux et la production de matière grasse du lait sont variables ; il en résulte parfois un taux supérieur de matière grasse, tandis que dans d'autres cas il ne change pas, et que, dans d'autres cas encore, il diminue. Il semble que l'état de chair de l'animal, le degré de sous-alimentation et la saison influent sur ces variations.

En ce qui concerne la protéine du lait, la sous-alimentation agit parfois défavorablement ; dans d'autres cas, l'action entraînant diminution ne porte que sur la caséine. Lorsqu'elle diminue la protéine totale, elle diminue aussi les cendres.

La sous-alimentation, même si elle est physiologique, a une action marquée sur les constantes physiques et chimiques de la matière grasse du lait. Elle augmente l'indice de REICHERT-MEISSL et l'indice de saponification, et diminue par contre l'indice d'iode. Le point de fusion augmente, reste sans changement, puis diminue, suivant les cas, et sous la dépendance



de l'augmentation et de la diminution respectives des acides gras volatils et de l'acide oléique. Les premiers ont une influence beaucoup plus grande que les seconds sur le point de fusion du beurre. Le maïs ensilé et d'autres aliments qui augmentent les acides gras volatils du beurre ont une action sur le degré du caractère anormal des constantes du beurre dépendant de la sous-alimentation, mais non sur la quantité de la variation. Les effets de la sous-alimentation sur les constantes de la matière grasse semblent atteindre une limite lorsqu'on arrive à 40 % de l'alimentation normale. Une sous-alimentation prolongée pendant une longue période finit par ramener approximativement les constantes, sans cependant jamais les atteindre complètement. L'augmentation de la matière grasse du lait pendant la sous-alimentation ne s'explique pas par l'hypothèse suivant laquelle elle se produirait aux dépens des tissus gras du corps, par suite de leur migration vers les glandes mammaires, car les analyses du sang faites à cet égard n'ont indiqué aucune augmentation de matière grasse dans le sang. Les AA. émettent, comme base d'une explication de ce phénomène, l'hypothèse que la synthèse de la matière grasse du lait en quantité normale et sa synthèse en composition normale seraient des fonctions physiologiques dépendantes les unes des autres. La production de la quantité normale de matière grasse du lait est réglée par l'activité des lipases et des enzymes qui accélèrent cette réaction synthétique dans les glandes mammaires, et elle est influencée fortement par les changements de l'activité métabolique générale de l'organisme, et principalement par les changements qui ont une action sur le métabolisme de la graisse.

Grâce à cette hypothèse, il est possible d'expliquer les variations normales du taux de matière grasse du lait, les variations qui se produisent entre certains extrêmes de température du milieu, et aussi les variations qui se produisent dans les effets de la sous-alimentation sur le taux de matière grasse du lait, surtout celles qui paraissent en rapport avec l'embonpoint et la maigreur de l'animal.

La synthèse de la matière grasse du lait, de composition normale, est réglée par les variations dans la quantité et la qualité des matières amenées aux glandes mammaires par la circulation du sang d'où elles tirent leur origine et où se forment normalement les constituants ordinaires du lait, et en particulier les éléments qui caractérisent la matière grasse du lait, à savoir les acides volatils. Une extension ultérieure de cette phase de l'hypothèse est limitée par le manque de données sur les éléments constituants du sang utilisés dans la formation de la matière grasse normale du lait.

Les effets de la sous-alimentation sur la composition et sur les propriétés du lait et de sa matière grasse montrent l'importance du contrôle de ce facteur dans les expériences d'alimentation, y compris les effets produits par des aliments spéciaux. Il faut tenir compte des effets de la sous-alimentation dans l'interprétation de toutes les données relatives à des variations dans la composition du lait et de sa matière grasse par l'effet des conditions spéciales de la vache et du milieu, non moins que par suite de variations d'aliments et d'aliments à caractères spécifiques.

De telles variations de la composition et des propriétés du lait, par l'effet de la sous-alimentation, peuvent avoir une importance spéciale dans le problème de l'humanisation du lait de vache, mais il faut encore d'autres études pour connaître dans quelles limites on en peut tirer profit à cet égard.

348 - Valeur du maïs ensilé pour l'alimentation des vaches laitières; expérience aux Etats-Unis. — DORMAN J. E., dans *Hoard's Dairyman*, Vol. LII, N° 23, pp. 800 et 820. Fort Atkinson, Wisconsin, 29 Décembre 1916.

Le fourrage ensilé n'a pas de valeur marchande proprement dite, car il est ordinairement consommé sur place par le bétail; aussi a-t-on fait beaucoup de calculs pour connaître sa valeur réelle comme aliment des vaches laitières.

*Résultats de l'expérience avec maïs ensilé.*

	Lait produit	Matière grasse produite
Septembre: pâturage, foin et aliments concentrés .	12 809,84 kg	421,75 kg
Octobre: pâturage, foin et aliments concentrés .	11 574,71	382,42
Novembre: foin et fourrage ensilé . . . . .	13 166,81	419,66
Diminution de la production de septembre à octobre . . . . .	1 235,13	39,33
En supposant une diminution égale d'octobre à novembre, soit . . . . .	1 235,13	39,33
La diminution totale sans fourrage ensilé serait de .	2 470,25	78,65
La production de novembre avec le fourrage ensilé a été de . . . . .	13 166,81	419,66
Sans fourrage ensilé elle aurait été de . . . . .	10 339,58	343,09
La diminution totale sans fourrage ensilé aurait été de . . . . .	2 827,23	76,57

De ces productions, on peut tirer les valeurs suivantes:

Valeur de l'augmentation en matière grasse, à 3,16 fr le kg. . . . .	240,57 fr
Valeur de l'augmentation en lait écrémé, à 2,55 fr le quintal. . . . .	80,74 fr
<i>Valeur totale de l'augmentation de production</i>	<u>321,31 fr</u>
Augmentation de valeur correspondant à chaque tonne de fourrage ensilé consommée par les vaches. . . . .	17,82 fr
Chaque tonne de fourrage ensilé a remplacé :	
149,68 kg d'aliments concentrés évalués à 10,2 fr le quintal . . .	17,10 fr
163,29 kg de foin évalué à 2,856 fr le quintal (1). . . . .	8,55 fr
<i>Valeur de 1 tonne de fourrage ensilé</i>	<u>43,47 fr</u>

(1) Depuis l'époque où cette expérience a été faite, les prix du foin et des aliments concentrés ont presque doublé.

Les éleveurs qui font usage du maïs ensilé connaissent en général le coût unitaire de la culture et de l'ensilage de cette céréale, et, comme ils obtiennent à un prix de revient relativement bas de grandes quantités de fourrage pour l'hiver par unité de superficie, ils continuent de construire



des silos et de les remplir en automne sans trop se soucier de la théorie de l'alimentation du bétail.

Or, l'analyse du maïs ensilé montre que sa valeur nutritive ne dépasse pas  $\frac{1}{4}$  de celle du foin de fléole ; si celui-ci est coté 80 fr la tonne, il ne vaudrait donc pas plus de 20 fr la tonne. En revanche, dans la pratique de l'alimentation, le maïs ensilé présente des avantages dont l'analyse chimique ne tient pas compte. Ainsi, les producteurs de lait qui l'utilisent savent que leur bétail fournit davantage de lait et se maintient en meilleure santé lorsque sa ration hivernale comprend du fourrage ensilé.

Les chiffres du Tableau ci-joint, fournis par une expérience effectuée à ce sujet, montrent que le fourrage ensilé contribue notablement à maintenir élevée la production du lait, qui, sans son emploi, diminuerait plus rapidement. Quoique cette expérience ne soit pas assez étendue pour fournir des conclusions définitives, elle met toutefois en lumière les faits observés chez la plupart de troupeaux alimentés en automne-hiver avec fourrage ensilé, et elle montre que celui-ci a une valeur sensiblement supérieure à celle qu'on lui attribue généralement.

L'expérience a porté sur 40 vaches (choisies dans un troupeau de 71) qui avaient vêlé avant le 1<sup>er</sup> septembre et se trouvaient conséquemment, en pleine période de lactation durant les mois de septembre, octobre et novembre.

349 - **Élevage, alimentation et entretien du bétail laitier dans les exploitations laitières de l'Iowa, États-Unis.** — KILDEE H. H., dans *Sixteenth Annual Iowa Year Book of Agriculture*, pp. 495-532. Des Moines, Iowa, Juillet 1916.

L'industrie laitière se prêtant admirablement à être introduite dans les zones à agriculture mixte et intensive, elle s'étend rapidement dans presque toutes les parties de l'Iowa où les terrains augmentent constamment de valeur, d'une façon analogue à ce qui se passe en Europe dans l'île de Jersey, où le terrain se loue de 640 à 748 fr par ha, et en Hollande (384 à 512 fr), pays où la vache laitière constitue la base de l'exploitation agricole.

**L'EXPLOITATION LAITIÈRE AUGMENTE LA FERTILITÉ DU SOL.** — Celle-ci tend à augmenter plutôt qu'à diminuer dans les fermes vouées à la production laitière et, dans l'Iowa, il ne manque pas d'exemples d'exploitations, autrefois peu fertiles, qui ont été radicalement transformées en peu d'années, à ce point de vue, au moyen de la transformation des fourrages par le bétail laitier, et grâce à l'achat d'aliments complémentaires concentrés.

**ÉCONOMIE DE LA PRODUCTION.** — La vache laitière a en sa faveur un facteur économique d'une grande importance car, pour 100 kg de matières nutritives pouvant être digérées et consommées, elle produit dans le lait une quantité de matières alimentaires environ 6 fois supérieure à celle que produit l'engraissement des bovins ou des ovins. Elle est une machine à production plus économique, et, de plus, une source de profits plus sûre que celle de l'engraissement, car les produits en sont moins sujets aux fluctuations inattendues du marché, et ils fournissent un revenu à jet continu. En outre, dans les exploitations laitières qui s'occupent de la production du beurre, le lait écrémé permet, grâce à sa valeur nutritive élevée, de pratiquer avec succès l'élevage des porcs et l'élevage des oiseaux de basse-cour.

**LA TRAITE MÉCANIQUE COMME FACTEUR ÉCONOMIQUE IMPORTANT.** — La traite mécanique donne déjà des résultats satisfaisants dans un grand nombre d'exploitations de l'Iowa. Elle sert à éliminer le plus grand obstacle qui s'oppose à la diffusion de l'industrie laitière, à savoir la difficulté de trouver de bons trayeurs.



LA LOI ÉCONOMIQUE DE LA PRODUCTION NORMALE DANS L'IOWA. — Bien que, comme classe de bétail de rapport, les vaches laitières constituent une catégorie de producteurs très économiques, il y a actuellement dans l'industrie laitière de l'Iowa bien des vaches laitières qui n'arrivent pas à transformer économiquement les aliments consommés. Dans l'Iowa, la production moyenne de matière grasse du lait ne dépasse actuellement pas 63,4 kg par vache à l'année. Par contre, il y a de nombreux individus qui produisent annuellement plus de 226,5 kg à l'année; un certain nombre de vaches produisent plus de 317 kg; quelques-unes dépassent 362 kg, et la vache *Guernsey Dairy Maid of Pinchurst* a produit 412,53 kg de matière grasse en 1 an. Le record mondial de production de matière grasse, pour toutes les races, est tenu par la vache Holstein de 3 ans *Finderne Holingen Fayne* avec 486,48 kg, tandis que le record mondial pour la production du lait est tenu par la vache Holstein *Lilly al Corta*, élevée dans l'Iowa, avec 13 812,45 kg de lait produit en 1 an.

Si l'on tient compte du fait fondamental que le coût d'entretien d'une vache n'est pas proportionnel à sa production de lait, le présent coefficient moyen de production n'est pas du tout satisfaisant. Un tiers des vaches laitières de l'Iowa se compose d'animaux physiquement inférieurs, par leur conformation comme vaches laitières, et par leur capacité de production. La moitié du reste pourrait probablement produire le double avec un régime alimentaire et un entretien plus rationnels.

EXEMPLE D'AMÉLIORATION DES VACHES LAITIÈRES DE L'IOWA. — Les données suivantes concernent le troupeau de PEDER PEDERSON et fils, inscrit à l'Association de contrôle de la production des vaches laitières de Benson (« Benson Cow Testing Association »). Elles sont un exemple pratique du résultat obtenu 3 années de suite, en contrôlant la production de chaque vache, pour remplacer les vaches improductives par des vaches productives, et en alimentant rationnellement le troupeau laitier bien entretenu.

Années	Production moyenne de lait par vache	Production moyenne de matière grasse par vache	Revenu moyen par vache, frais d'alimentation déduits	Revenu maximum donné par :
—	—	—	—	—
1911	2 569,94 kg	94,21 kg	114,63 fr	1 vache : <b>280,99</b> fr
1912	3 202,34	114,26	279,64	1 vache : <b>550,89</b> fr
1913	4 398,67	155,10	388,68	2 vaches : <b>746,28</b> fr

Ce troupeau se composait de vaches améliorées par croisement (« grade ») et de quelques Holstein pur sang.

CHOIX DES VACHES. — Les vaches Jersey et Guernsey sont appréciées pour leur production économique d'un titre élevé en matière grasse, surtout dans des conditions intensives d'élevage. Les Holstein sont très populaires dans l'Iowa à cause de leur capacité d'utiliser une grande quantité de fourrages produits dans l'exploitation et à cause de la quantité de lait qu'elles fournissent, qui rend aussi de grands services dans l'élevage des veaux, des porcs et de la volaille. Les Ayrshires sont connues pour leur rusticité, et elles produisent une assez bonne quantité de lait et de matière grasse. Le choix de la race a pourtant moins d'importance que le choix des individus, car, dans chaque race, il y a des vaches de valeur et des vaches médiocres. Il est, par contre, de la plus grande importance de considérer : la conformation de l'animal, qui doit être décidément du type laitier ; sa production laitière ; celle de ses ascendants, et surtout celle de son aïeule maternelle.

CHOIX DES TAUREAUX. — Nombre des meilleurs éleveurs choisissent des taureaux presque exclusivement en se basant sur la production laitière des vaches dont ils descendent. On obtiendrait de meilleurs résultats en s'en tenant à des taureaux d'âge mûr, déjà éprouvés, bien

que ce ne soit pas la voie généralement suivie. Un bon taureau capable d'élever la production moyenne de matière grasse du troupeau de 25 à 50 kg par tête à l'année a une grande valeur.

**CHOIX DES ALIMENTS.** — La ration des vaches laitières requiert les qualités suivantes : savoir — volume — succulence — variété — composition — combinaison bien équilibrée des matières nutritives digestibles et facilité d'administrer les aliments. La meilleure combinaison des matières nutritives digestibles (protéines, hydrates de carbone, matières grasses, cendres) varie suivant : les caractères individuels de la vache — la quantité et qualité du lait qu'elle produit — les prix des aliments — et aussi selon que la vache se trouve ou non en période de gestation. En général, cependant, les vaches qui tendent à engraisser exigent moins d'hydrates de carbone et plus de protéines, tandis que celles à tendance opposée exigent une plus grande quantité d'hydrates de carbone. Chez les vaches alimentées avec des rations d'entretien insuffisantes pour la production du lait, celle-ci se fait aux dépens des tissus de l'organisme ; aussi diminue-t-elle rapidement et cesse-t-elle au 5<sup>ème</sup> ou au 6<sup>ème</sup> mois après la parturition. Dans quelques cas, ce manque de persistance de la période de lactation est dû à des caractéristiques héréditaires de l'animal, en plus de l'alimentation insuffisante. Au point de vue pratique de l'alimentation, les exploitations laitières qui produisent des foins de trèfle, de luzerne, d'avoine de pois, etc., ont besoin d'une quantité relativement faible de matières protéiques complémentaires, que l'on peut trouver économiquement dans les aliments concentrés.

**LES FOURRAGES ENSILÉS ET LEUR EFFICACITÉ.** — Une exploitation laitière n'est pas complète si elle ne possède pas au moins 1 silo pour l'alimentation d'hiver, et 1 silo de dimensions un peu moindres pour l'alimentation d'été. Le maïs ensilé est le fourrage du bétail laitier par excellence. Il est savoureux, succulent, volumineux, hygiénique pour le tube digestif et économique. De très nombreux propriétaires d'exploitations laitières de la zone du maïs sont absolument convaincus que, pour obtenir des profits de l'exploitation laitière, il faut alimenter les vaches de maïs ensilé ; là où le maïs n'est pas économiquement cultivable, les agriculteurs les plus avisés ont recours à d'autres cultures pour ensilage. De nombreuses expériences pratiques ont démontré d'une manière définitive que le maïs ensilé est de beaucoup supérieur au maïs non ensilé et aux foins dans la production du lait (1). A l'unité de superficie, le maïs ensilé donne 11 à 18 % de lait en plus que le maïs non ensilé. Seules les raves et les betteraves fourragères peuvent remplacer comme qualité le maïs ensilé, dans la production laitière, mais là aussi d'innombrables essais pratiques démontrent que, à l'unité de superficie, le maïs ensilé produit davantage, que les racines, avec une dépense beaucoup moindre, tandis que la production, à égalité de matière sèche, reste égale. En outre, pendant les mois de juillet et d'août, alors que la pâture est fortement réduite par la sécheresse, le maïs ensilé représente pour le troupeau laitier un succédané précieux des fourrages verts. Avec les fourrages artificiels et le maïs ensilé pendant cette période de l'année, on arrive non seulement à maintenir la production laitière, mais aussi à l'augmenter, tandis que sans ces aliments, lorsque le lait a une fois diminué au cours de la période de lactation déjà avancée, il est presque impossible d'en augmenter encore la production à la fin de l'été ou au commencement de l'automne au moment où réapparaissent les pâtures et les fourrages frais.

**PRAIRIES ARTIFICIELLES.** — Les pâtures des exploitations laitières de l'Iowa ne suffisent pas à alimenter le bétail laitier pendant les mois chauds de l'été. On remédie à cet inconvénient en : 1) améliorant les pâtures pour augmenter leur production ; 2, recourant à l'ensilage d'été ; 3) établissant des prairies artificielles (« soiling crops ») d'été et d'automne. L'Exploitation laitière expérimentale de l'École supérieure d'Agriculture de l'Iowa (« Iowa State College Dairy Farm ») a employé avec succès les fourrages artificiels suivants :

(1) Voir N° 348 de ce *Bulletin*.

(N. d. R.).

Plantes fourragères	Époque de semaille	Quantité de semence par ha	Époque de coupe	Production moyenne de fourrage vert par ha, en tonnes
Luzerne . . . . .	Printemps ou août	22,5 kg	10-15 juin (1 <sup>ère</sup> coupe)	18
Avoine et pois du Canada . . . . .	5 avril	{ 130 litres d'avoine 130 litres de pois	15 juin-5 juillet	11
Avoine et pois du Canada . . . . .	20 avril	{ 130 litres d'avoine 130 litres de pois	1 <sup>er</sup> -10 juillet	11
Luzerne. . . . .	Printemps ou août	22,5 kg	10-15 juillet (2 <sup>ème</sup> coupe)	9
Canne à sucre fourragère «Amber» .	5 mai	78,5 kg	10-20 juillet	45
Canne à sucre fourragère et «cowpeas» ( <i>Vigna Catjang</i> ) .	15 mai	{ 34 kg de canne 86,4 kg de «cowpeas»	15 juillet-15 août	27
Canne à sucre fourragère et «cowpeas» . . . . .	10 juin	{ 34 kg de canne 86,4 kg de «cowpeas»	15 août-20 septembre	27
Millet . . . . .	10 juillet]	65,2 litres	20 septembre-gelées d'automne	6,7

Grâce à l'emploi de ces fourrages artificiels, la production laitière du troupeau a pu être augmentée pendant l'été avec une superficie herbagère moindre. En 1912, la dépense totale occasionnée par l'entretien du bétail pendant la saison de pâture n'a été, grâce à ces fourrages artificiels, que de 343 fr par vache, en tenant compte de tous les frais de main-d'œuvre, location du terrain, etc.

PRÉPARATION DE LA VACHE POUR LA PRODUCTION LAITIÈRE. — L'alimentation pour la production laitière doit commencer 6 à 8 semaines avant la parturition, période préliminaire indispensable pour préparer l'animal à une production élevée. Les aliments employés pendant cette période doivent être facilement digestibles, rafraîchissants pour le tube digestif, et nourrissants au point de pourvoir au développement du veau à naître et à l'engraissement de la mère pour lui donner le maximum de robustesse.

SOINS PENDANT LES 30 PREMIERS JOURS QUI SUIVENT LA PARTURITION. — Après les soins rationnels à donner pendant les 3 premiers jours qui suivent la parturition, on passe à l'alimentation solide, en tenant compte que l'alimentation pendant le 1<sup>er</sup> mois a une influence considérable, par le fait qu'elle détermine le travail productif total que la vache effectuera pendant la lactation. La parturition affaiblit indubitablement l'appareil digestif, et l'alimentation excessive avec des aliments de digestion difficile produit facilement des conséquences qui se font sentir longtemps. D'autre part, c'est précisément pendant le 1<sup>er</sup> mois que, grâce à une alimentation intensive rationnelle, il faut pousser l'animal à son effort maximum de production.

QUANTITÉ D'ALIMENTS À DONNER. — La condition, l'individualité et la production de la vache influent sur le choix de la ration. Toutefois, dans l'Iowa, il y a une pratique maintenant communément adoptée qui consiste à donner 1 kg d'aliments concentrés pour 2,5 à 4 kg de lait produit, suivant le titre du lait, ou bien 7 kg desdits aliments par kg de matière grasse dans le lait. Outre cette ration de céréales, on donne aussi de 1 à 1,5 kg de foin de trèfle ou de luzerne et de 2,5 à 3 kg de maïs ensilé par 100 kg de poids vif. Les mélanges suivants d'aliments concentrés ont les qualités requises voulues pour être donnés selon la formule mentionnée plus haut pour le bétail laitier :



Mélange A :	Mélange B :	Mélange C :	Mélange D :
400 kg de « cracked corn » ou de « corn and cob meal » (1)	400 kg de « cracked corn »	400 kg de « corn and cob meal »	300 kg de « corn and cob meal »
200 kg d'avoine concassée	100 kg d'avoine concassée	200 kg de tourteau de lin moulu	200 kg de tourteau de lin moulu
100 kg de tourteau de coton moulu	100 kg de « gluten feed » (2)	100 kg de « gluten feed »	100 kg de tourteau de coton moulu
100 kg de tourteau de lin moulu	100 kg de tourteau de coton moulu	100 kg de drèches de brasserie desséchées	
	100 kg de tourteau de lin moulu.		

(1) « Cracked corn » = maïs concassé — « Corn and cob meal » = farine d'épis de maïs avec les rachis.

(2) « Gluten feed » = gluten et son de maïs moulus ensemble.

**EMPLOI DU GRAIN EN ÉTÉ.** — Les agriculteurs ne sont pas tous d'accord sur l'utilité de donner du grain même durant le pâturage. Une pratique employée par beaucoup d'agriculteurs et adoptée par l'exploitation laitière expérimentale consiste à ne pas donner de grain aux élèves pendant le 1<sup>er</sup> mois de pâturage pour leur faire avoir ainsi une période de repos ; ensuite, pour maintenir à son niveau élevé la production, outre le maïs ensilé, les fourrages artificiels et le pâturage on donne de petites quantités d'aliments concentrés. Cela sert surtout à maintenir les vaches bien en chair.

**MOYENS DE PROLONGER LA FORTE PRODUCTION DE LAIT.** — Ils consistent surtout à éliminer les vaches qui ont, héréditairement, une courte période de lactation, et à observer les points suivants : 1) alimentation rationnelle ; 2) parturition automnale tardive ; 3) traite et manipulation du pis rationnelles ; 4) régularité de la traite ; 5) bons traitements ; 6) bon entretien ; 7) abreuvement sain et abondant ; 8) usage de sel pour le pâturage ; 9) éloignement des mouches ; 10) abris et étables rationnels.

**PRODUCTION DE MATIÈRE GRASSE.** — Elle ne peut augmenter avec certitude et dans une mesure suffisante que par la production abondante et persistante du lait. Les facteurs suivants ont cependant eux aussi une notable influence : race — individualité — âge — période de lactation — conditions générales — excitabilité — fréquence des traites — saison — température — alimentation — commencement et fin de la traite.

**ÉLEVAGE DES VEAUX.** — Durant les 3 premières semaines après la naissance, après les premiers jours d'allaitement maternel, les veaux reçoivent, 3 fois par jour, de 0,900 à 1,585 kg de lait fraîchement trait. A 3 semaines, on remplace à l'un des 3 repas le lait entier par du lait écrémé, et ensuite, lorsqu'on passe au régime de 2 repas par jour, on remplace graduellement le lait entier par le lait écrémé, de façon à opérer la substitution complète en 3 semaines. A l'âge de 6 semaines, on devrait donner à l'animal de 5,43 à 7,25 kg de lait écrémé. En ayant soin d'éviter les indigestions de lait écrémé, on peut arriver à en donner 8,2 kg par jour en pleine alimentation. Cette alimentation au lait écrémé se pratique chez beaucoup d'éleveurs jusqu'au 8<sup>ème</sup> mois.

**EMPLOI DU GRAIN ET D'AUTRES ALIMENTS CONCENTRÉS POUR LES VEAUX.** — Certains éleveurs emploient des mélanges à parties égales de maïs, d'avoine et de son avec de petites quantités de tourteau de lin, pour compléter la ration de croissance. Les veaux nés en automne ou au commencement de l'hiver réussissent très bien au pâturage, le printemps suivant, avec l'addition de petites quantités de grain. Ils ont cependant besoin d'abris contre le soleil d'été et les pluies. Ceux qui sont nés au printemps sont élevés de préférence dans les étables pendant l'été.

**SUCCÉDANÉS DU LAIT POUR L'ÉLEVAGE DES VEAUX.** — Le marché américain des aliments concentrés comprend diverses marques de farines pour l'élevage des veaux ; elles semblent donner d'excellents résultats, surtout quand on les associe à des quantités relativement faibles

# DAIRY FARM DEPARTMENT, Iowa State College, Ames, Iowa.

Depuis le vèlage  
114 j.

Age  
5 ans  
1 mois  
25 jours

Photographiée le  
19 février 1912

Photographie

Nom: *Lucy Duchess De Kol*  
Registre généalogique N° 96 348  
Née le: 20 décembre 1906  
Père: *Count De Kol Colville Baun* N° 30 609  
Mère: *Lucy Duchess Lyons* N° 78 965  
Achètee de: *Esther A. Horr*  
Dernière vente:

Race: *Holstein*  
Advanced Registry N° 16 079  
Nom de l'éleveur: *Esther A. Horr*  
Nom de l'éleveur: *Esther A. Horr*  
Nom de l'éleveur: *Esther A. Horr*  
Adresse: *Wellingtion, Ohio*

N° dans le troupeau: 44  
Classe:  
Adresse: *Wellingtion, Ohio*  
Adresse: *Wellingtion, Ohio*  
Adresse: *Wellingtion, Ohio*  
Date d'achat: 3 décembre 1907

## DONNÉES CONCERNANT L'ÉLEVAGE.

Date de la saillie	Nom du taureau	N° du taureau	Date prévue du vèlage	Date effective du vèlage	Poids du veau, en kg	Sexe	N° dans le troupeau	Nom du veau	N° du registre généalogique	Vendu à	Adresse	Mois et année	Au prix de	Qualité du bétail laitier de l'acheteur
1 12 janv 1908	<i>Colantha IV Lad</i>	26 940	21 oct. 1908	23 oct. 1908	97 M	83	<i>Prince De Kol of Ames</i>			<i>Sweeney Bros.</i>	<i>North Buena Vista Iowa</i>	juin 1909	389 fr	
2 18 août 1908	<i>Id.</i>	26 940	27 mai 1910	29 mai 1910	100 M	113	<i>Sir Colantha De Kol Lad</i>			<i>W. S. Winstler</i>	<i>Hillsboro Iowa</i>	mars 1911	1036 fr	
3 17 janv 1911	<i>Id.</i>	26 940	24 oct. 1911	27 oct. 1911	102 M	159	<i>Duke Colantha De Kol</i>			<i>Oak Park Academy</i>	<i>Newada Iowa</i>	juin 1912	777 fr	
4 12 juin 1912	<i>Id.</i>	26 940	21 mars 1913	22 mars 1913	75 M	210								
5 23 juill. 1913	<i>Sir Jessie Tobes Fiebe Burke.</i>	41 215			70 M	211								

## DONNÉES CONCERNANT LA PRODUCTION DE LAIT ET DE MATIÈRE GRASSE.

Production annuelle de lait et de matière grasse												Épreuves officielles											
Période de lactation		Durée		Age au début		Lait produit, en kg	Matière grasse produite, en kg	Taux de matière grasse	Rendement net, frais d'alimentation déduits	Période d'épreuve		Durée		Age au début		Lait produit, en kg	Matière grasse de la tête, en kg	Taux de matière grasse	Beurre produit, en kg				
du	au	Mois	Jours	Années	Mois					Jours	du	au	Mois	Jours	Années					Mois	Jours		
1 27/XI/1908	26/XI/1909		365	1	11	7	4 652,79	143,35	3,1 %		16/X/1911	22/X/1911		7	4	10	7	184,07	7,03	3,82 %			
2 30/V/1910	30/V/1911		365	3	5	11	6 132,26				16/X/1911	16/X/1912		365	4	10	7	7 708,72	250,73	3,25 %			
3 16/X/1910	16/X/1912		365	4	10	7	7 701,50																

Au verso de cette table se trouve l'arbre généalogique de l'animal, avec 16 quartiers pour les animaux pur sang / 8 quartiers pour les animaux en voie d'amélioration par croisement avec les pur sang, seulement dans la branche paternelle. Cette généalogie mentionne en outre tous les autres produits célèbres des ascendants, avec leur N° du Registre généalogique et l'indication des quantités de lait et de matière grasse produites: a) par les vaches-mères; b) par les filles des taureaux.



de lait. A la « Pennsylvania Experiment Station » on a obtenu de bons résultats en administrant le mélange suivant : farine de blé 13,59 kg — tourteau de coprah moulu 11,32 kg — « Nutrium » (produit des industries des aliments concentrés) 9,06 kg — tourteau de lin moulu 4,53 kg — farine de sang 0,96 kg — délayé dans l'eau chaude à raison de 1 kg de mélange pour 6 kg d'eau. Après 1 semaine, l'allaitement [maternel] était remplacé graduellement par cette buvée jusqu'à être complètement supprimé au bout de 2 mois ; pendant les 5 ou 6 premières semaines, on donnait de 0,9 à 1 kg de ce mélange par jour, puis, jusqu'à l'âge de 100 jours, 1,13 kg, pour passer ensuite à l'alimentation au foin et au grain. Avec ce système, on a élevé d'excellentes génisses, bien que les résultats aient été inférieurs à ceux de l'élevage au lait, mais la dépense s'en trouvait considérablement réduite.

**ÉLEVAGE DES GÉNISSES.** — Les rations d'hiver suivantes pour génisses de 1 an ont donné d'excellentes résultats :

I.	II.	III.
Maïs ensilé . . . . . 9,071 kg	Foin de trèfle ou de . . . . .	Foin de trèfle ou de . . . . .
Foin de trèfle ou de . . . . .	luzerne . . . . . 6,79 kg	luzerne . . . . . 6,79 kg
luzerne . . . . . 3,620	Grain . . . . . 0,45	Grain . . . . . 1,36
Grain . . . . . 0,907	Racines . . . . . 9,07	

Le coût total de l'élevage d'une génisse jusqu'à l'âge productif est en moyenne de 260 à 310 francs.

**ALIMENTATION DU TAUREAU DU TROUPEAU.** — On a vu par expérience qu'il était mauvais de donner aux taureaux trop de maïs ensilé. A de petites quantités de maïs ensilé on ajoute communément du foin de luzerne ou de trèfle et la ration nécessaire d'aliments concentrés : mélange de : maïs, avoine, son et un peu de tourteau de lin.

**CONTRÔLE STATISTIQUE DU TROUPEAU.** — Le recueil méthodique des importantes données statistiques suivantes, qui exigent relativement peu de temps, est pratiqué par beaucoup d'éleveurs : production de lait — production de matière grasse de chaque vache — rations et leurs variations — données relatives à la reproduction et à l'élevage.

La feuille statistique de contrôle adoptée par l'Exploitation laitière de l'état d'Iowa (« Record Sheet of the Iowa State College Dairy Farm, Ames, Ia ») a été adoptée aussi par beaucoup d'autres à cause des excellents résultats pratiques qu'elle a donnés. Elle est reproduite à la page précédente.

OVIDÉS.

350 — **Etudes sur la croissance des agneaux en fonction de la quantité et du taux de matière grasse du lait des brebis-mères, aux Etats-Unis.** — RITZMAN E. G., dans *Journal of Agricultural Research*, Vol. VIII, N° 2, pp. 29-36. Washington, 8 Janvier 1917.

Au cours des expériences sur l'élevage des ovins faites à la Station agronomique du New-Hampshire, on a recueilli des données relatives à la production de lait et à son taux de matière grasse (1) pour 6 races distinctes d'ovins de boucherie et 11 types de croisements de la 1<sup>ère</sup> génération. On a étudié la croissance des agneaux en fonction de la production laitière de ces races ovines précoces de boucherie, pour mettre en évidence l'importance de la potentialité des races, dans la production du lait, en vue d'obtenir la précocité toujours plus indispensable pour que cet élevage procure des bénéfices.

Le taux moyen de matière grasse du lait de brebis est, comme on le sait, bien supérieur à celui du lait de vache, mais les oscillations d'un

(1) Voir aussi, à ce sujet, dans B. 1916, N° 539 : *Epreuves de rendement en lait et en laine faites sur brebis laitières, en Hongrie.*



individu à l'autre de la même race sont beaucoup plus grandes, et il y a des différences notables tant dans la même période de lactation que dans des périodes de lactation différentes. Il ne semble pas y avoir grandes différences à cet égard entre les races laitières sélectionnées pour le lait et celles qui ne le sont pas, y compris les races anglaises communes et celles du type Mérinos.

En ce qui concerne les races laitières, M. HUCHO indique, pour le lait de 3 brebis de la Frise orientale, des taux de matière grasse variant respectivement entre : 4,32 et 10,80 % — 4,35 et 7,50 % — 4,15 et 7,38 %. M. BESANA indique une moyenne de 9,50 % pour 176 échantillons de lait d'une race italienne indigène, représentant une période de 21 jours après la parturition. MM. TRILLAT et FORESTIER indiquent une moyenne de 6,98 % pour 10 échantillons provenant de brebis de Roquefort (France). M. SAUNA indique une moyenne de 7,53 % pour 55 échantillons de lait de brebis du midi de la Sardaigne. Pour les races autres que les races laitières, MM. FULLER et KLEINHEINZ, de la Station agronomique du Wisconsin, indiquent les taux de matière grasse suivants : Oxford 7,65 % — Southdown 8,4 % — Dorset 7,2 % — Shropshire 5,88 % — Mérinos 6 % — Montana 7,15 %. Ces taux représentent la moyenne pour un bon nombre d'individus, et ils concordent parfaitement avec ceux qui ont été obtenus par l'A. à la Station agronomique du New-Hampshire, où l'on a eu une moyenne générale de 6 % pour les races hybrides étudiées, avec des oscillations comprises entre un minimum de 2,4 % et un maximum de 12,1 %. Si l'on considère le taux de matière grasse en fonction de l'âge, on a les moyennes générales suivantes : 2 ans : 5,8 % — 3 ans : 6,2 % — 4 ans : 6,2 % — 5 ans : 6,38 % — 6 ans : 5,6 % — 7 ans : 5,3 % — 8 ans : 10,7 % (pour une brebis Southdown). Les oscillations respectives sont : 2 ans : 2,7 à 9,5 % — 3 ans : 2,4 à 11,4 % — 4 ans : 3,5 à 12,1 % — 5 ans : 2,4 à 10,5 % — 6 ans : 3,0 à 9,8 % — 7 ans : 3,6 à 7,0 %. Etant donné ces oscillations notables entre individus du même âge et entre individus de la même race ou du même croisement, les moyennes, pour les diverses races et les divers croisements, perdent beaucoup de leur valeur, car elles concernent un nombre souvent trop petit d'individus. De l'examen des données recueillies par l'A. sur le taux de matière grasse du lait de brebis, on doit conclure : que ce taux est un facteur très variable d'une brebis à l'autre, et cela indépendamment de l'âge et de la race ; que, en outre, le taux de matière grasse du lait d'une même brebis varie notablement dans les diverses périodes de lactation, et, pour la même période de lactation, suivant les diverses époques.

Le taux de matière grasse reste quantitativement le facteur le plus variable, même dans le lait de races sélectionnées pendant plusieurs générations en vue d'augmenter ce taux. Cette sélection n'est pas arrivée, jusqu'ici, à fixer le taux de matière grasse du lait, et cela également parce qu'on n'a pas encore établi une limite pour le taux de matière grasse *normal* (« standard »). Chez les races de boucherie, pour lesquelles on n'a pas encore tenté de modifier, par sélection, la production de lait et son taux de matière grasse, les variations de ce taux ont un degré égal d'instabilité ; elles ne peuvent du reste avoir de l'importance qu'en constituant un facteur de limi-

tation dans la précocité de développement des agneaux. Les recherches de l'A. à cet égard, comme cela ressort du Tableau ci-joint, font penser qu'il n'y a pas un rapport bien défini entre le taux de matière grasse et l'augmentation de poids, car l'augmentation maximum a été obtenue avec du lait ayant 2 à 3 % de matière grasse, et l'augmentation minimum avec du lait ayant 10 % de matière grasse. Le facteur de limitation semble être plutôt la quantité du lait, ainsi que cela ressort de l'augmentation moyenne indiquée dans le Tableau en fonction de la production de lait.

*Augmentation moyenne en poids des agneaux de 8 semaines relativement à diverses quantités de lait maternel à taux différents de matière grasse.*

Nombre de brebis	Production de lait (évaluée)	Taux moyen de matière grasse	Taux de matière grasse :									Moyennes	
			2-3 %	3-4 %	4-5 %	5-6 %	6-7 %	7-8 %	8-9 %	9-10 %	> 10 %		
Augmentations de poids													
			kg	kg	kg	kg	kg	kg	kg	kg	kg	kg	
13	Elevée	4,82 %	19,05	15,88	13,15	17,33	15,42	19,05	13,15	—	—	15,42	
78	Bonne	6,15	14,74	14,06	16,33	14,06	14,51	14,97	14,06	11,34	11,34	13,29	
35	Médiocre	6,05	—	11,34	10,21	12,47	12,02	10,89	11,79	10,34	9,98	11,16	
12	Basse	6,03	—	6,80	9,53	8,62	11,79	8,62	9,98	—	4,08	8,62	
138			Moyennes :	16,78	12,02	12,29	16,61	13,43	13,38	12,25	10,89	8,48	—

La différence d'accroissement en poids entre les agneaux de brebis à production de lait élevée et ceux de brebis à bonne production de lait est de 16 % ; entre les premiers et ceux des brebis médiocres, elle est de 38 % ; entre les premiers et ceux des brebis à production basse, elle est de 79 %.

L'A. en déduit que le lait, même s'il est normalement pauvre en matière grasse, en contient toujours une quantité suffisante pour les besoins de la croissance, pourvu que le lait soit fourni en quantité suffisante pour les besoins d'albuminoïdes et de matières minérales (surtout chaux) de l'organisme en voie de croissance.

L'examen des courbes de croissance permet de relever la grande uniformité de croissance entre les 4 groupes différents, et une augmentation maximum entre la 4<sup>ème</sup> et la 8<sup>ème</sup> semaine, suivie d'une augmentation un peu moindre entre la 8<sup>ème</sup> et la 12<sup>ème</sup> semaine, quand les agneaux avaient libre accès au foin et aux céréales donnés en quantités considérables.

A part l'influence héréditaire en ce qui concerne l'aptitude à l'engraissement, celui-ci trouve une limite en produisant une augmentation de poids dépendant de la rapidité de développement de l'individu. Ce développement, à son tour, ne dépend pas de l'engraissement, mais plutôt de la capacité de développement héréditaire et de l'abondance de la nourriture

spéciale requise. En d'autres termes, tandis que l'augmentation de poids due à l'engraissement ne peut être que relative, l'accroissement ne peut pas être limité dans le même sens. Les recherches récemment effectuées sur sa nature mettent davantage en évidence la grande importance de l'alimentation lactée dans les premiers stades de l'adolescence, et cela non seulement à cause des fonctions spécifiques des divers sels contenus dans les cendres, mais aussi à cause des plus récentes interprétations de la différenciation de structure entre les divers amino-acides dérivés des matières protéiques et de leur effet respectif sur la croissance. Les matières protéiques perdent dans ce cas leur caractère générique pour acquérir un caractère spécifique qui, suivant leur origine, prend aussi une grande importance relativement à la quantité disponible.

351 — **Bénéfices donnés par la production d'œufs en grand, en Angleterre.** — HANSON S. G., dans *The Journal of the Board of Agriculture*, Vol. XXIII, N° 10, pp. 997. Londres, Janvier 1917.

AVICULTURE.

Les données ci-jointes concernant la production d'œufs de 750 jeunes poules White Leghorn élevées et entretenues par l'A. ont été communiquées au « Board of Agriculture » (Ministère anglais de l'Agriculture). Elle peuvent avoir un intérêt spécial pour ceux qui élèvent la volaille en grand dans un but commercial, mais elles ne sont évidemment pas applicables à l'élevage de la volaille purement ménager tel que les agriculteurs et les horticulteurs le pratiquent généralement, et, en les publiant, le « Board of Agriculture » n'assume aucune responsabilité à cet égard.

Le Tableau ci-joint indique les prix mensuels des œufs effectivement réalisés, en gros, sur le marché de Londres, et aussi le total des frais généraux et des frais : d'alimentation, de main-d'œuvre, de transport par chemin de fer. L'incubation s'est faite d'avril à fin juin 1915. La production d'œufs est indiquée, mois par mois, du 1<sup>er</sup> novembre 1915 au 1<sup>er</sup> novembre 1916.

*Production d'œufs de 750 jeunes poules White Leghorn  
et bénéfices tirés de leur vente.*

	Mois de production	Nombre d'œufs pondus	Prix de vente par douzaine à Londres	Sommes tirées de la vente
1915	Novembre . . . . .	698	3,47 fr	202,40 fr
	Décembre . . . . .	5 393	3 99	1 803,35
1916	Janvier . . . . .	10 831	3,05	2 748,95
	Février . . . . .	13 078	2,21	2 403,30
	Mars . . . . .	16 384	1,89	2 582,06
	Avril . . . . .	16 974	1,58	2 229,70
	Mai . . . . .	15 216	1 89	2 398,57
	Juin . . . . .	13 064	2 21	2 401,10
	Juillet . . . . .	12 901	2 42	2 598,35
	Août . . . . .	10 790	2,84	2 550,22
	Septembre . . . . .	7 066	3,42	1 882,16
	Octobre . . . . .	3 246	3 57	964,73

125 641 œufs . . . . . 24 764,89 fr



## CALCUL DU BÉNÉFICE TOTAL :

Produit total de la vente des œufs . . . . .	24 764,89 fr
A déduire : Frais généraux d'entretien, frais d'alimentation, de main-d'œuvre, de transport par chemin de fer, etc. . . . .	11 822,53 fr
<i>Bénéfice net pour 750 poules</i>	<u>12 942,36</u>

## CALCUL DU BÉNÉFICE MOYEN PAR POULE :

Récette moyenne par poule (pondant en moyenne 167,5 œufs) . .	33,00 fr
Dépense moyenne par poule . . . . .	15,76 fr
<i>Bénéfice net moyen par poule</i>	<u>17,24 fr</u>

## SÉRICICULTURE

352 - Contribution à l'étude des fonctions génératrices des papillons du ver à soie relativement à la position des cocons dans la bruyère. — SACCHI ROSA, dans *Le Stazioni Sperimentali agrarie italiane*, Vol. I, N° 1, pp. 25-32, 3 fig. Modène, 1917.

Le prof. VERNON en 1894, puis KATÔ en 1913 ont constaté que le ver à soie, au moment de se transformer en chrysalide, cherche à se placer la tête en haut et que, dans la plupart des cas, la chrysalide se place dans le cocon droite et la tête en haut. KATÔ s'est demandé si cette position ne serait pas nuisible à la reproduction, car les chrysalides renfermées dans des cocons disposés verticalement pèsent de tout leur poids sur l'extrémité abdominale, qui s'aplatit et se déforme au détriment des organes de la génération (1). D'autres savants (prof. MOZZICONACCI, M<sup>lle</sup> GIUSEPPINA RAVENNA) ont refait ces études et ont obtenu des résultats non concordants ; aussi l'A. a-t-il jugé opportun de les répéter une fois encore, au R. Istituto Superiore Agrario de Pérouse, sur les races : « Giallo Ascoli », « Giallo Abruzzo », « Incrocio Chinese oro ». Il a confirmé les observations de VERNON et de KATÔ.

On fit monter des vers de race « Incrocio Chinese oro » sur un petit fagot de bruyère à balais disposé verticalement, et des vers de la même race sur un autre fagot disposé horizontalement. Chez 20 cocons du 1<sup>er</sup> groupe (A), on constata que la chrysalide avait les anneaux abdominaux déformés ; chez 20 du 2<sup>ème</sup> groupe (B), toutes les chrysalides étaient normalement conformées ; 17 couples de papillons du groupe A et 16 du groupe B n'accusèrent aucune différence sensible dans le comportement du papillon lors de l'accouplement ; par contre, dans la ponte, le groupe A fournit en comparaison du groupe B un poids d'œufs inférieur, un plus grand nombre d'œufs stériles, un nombre beaucoup plus grand d'œufs restés dans les tubes de l'ovaire, comme l'indique de Tableau ci-joint.

Il est donc conseillable, pour l'élevage destiné à la reproduction, de placer la bruyère horizontalement, en la disposant, par exemple, sur des claies pareilles à celles sur lesquelles on élève ordinairement le ver à soie. Dans une bruyère placée ainsi, le ver à soie fait ordinairement son cocon en orientant le grand axe dans le sens horizontal, de sorte que la chrysalide a la tête et l'abdomen au même niveau, position qui permet à l'ex-

(1) Voir aussi B. 1916, N° 327.

(N. d. R.).

trémité abdominale et aux organes de la reproduction d'acquérir leur conformation naturelle, ce qui constitue un avantage pour la production des œufs.

*Comportement, lors de la ponte, des papillons provenant de cocons verticaux (groupe A) comparés aux papillons provenant de cocons horizontaux (groupe B).*

	Groupe A	Groupe B
Nombre de pontes . . . . .	17	16
Poids total des œufs . . . . .	3 021 g	3 311 g
Poids moyen des œufs d'une ponte . . . . .	0,177 g	0,206 g
Nombre d'œufs stériles . . . . .	536	150
Nombre de pontes complètes . . . . .	4	12
Nombre de pontes incomplètes . . . . .	13	4
Nombre minimum d'œufs restés dans les tubes de l'ovaire . . . . .	1	3
Nombre maximum d'œufs restés dans les tubes de l'ovaire * . . . . .	437	12

\* Chez cette race, un papillon ayant l'abdomen conformé normalement avait dans les tubes de l'ovaire, avant la ponte, 462 œufs en moyenne.

### 353 - Questions de sériciculture en Espagne : Bénéfice moyen de l'élevage du ver à soie en années normales ; Activité du Gouvernement pour propager cet élevage. —

MINISTERIO DE FOMENTO, *Dirección general de Agricultura, Minas y Montes, Servicio de Publicaciones agrícolas, Hojas divulgadoras*, X<sup>ème</sup> Année, N<sup>o</sup> 20, 8 pp. Madrid, Octobre 1916.

Article de propagande en vue d'étendre l'élevage du ver à soie en Espagne. Le bénéfice moyen, en années normales y est établi de la manière suivante :

#### DÉPENSES.

1 once de graines sélectionnées . . . . .	12,00 fr
9 quintaux de feuilles de mûrier, à 5 fr le quintal . . . . .	45,00
12 journées du chef de la famille de magnaniers à 2 fr la journée . . . . .	24,00
2 rames de papier usagé pour le lit des vers à soie et pour la récolte des cocons, à 3,25 fr la rame . . . . .	6,50
2 charretées de matériaux pour la montée, à 1,50 fr l'une . . . . .	3,00
<i>Dépenses totales</i>	<u>90,50 fr</u>

#### RECETTES.

69 kg de cocons à 2,50 fr le kg . . . . .	241,50 fr
<i>Bénéfice net</i>	<u><u>151,00 fr</u></u>

Pour favoriser le développement de l'élevage des vers à soie, en Espagne, la loi du 4 mars 1915, publiée dans la *Gaceta oficial* du lendemain, établissait ce qui suit : 1) Distribution gratuite aux agriculteurs de jeunes plants de mûrier des variétés requises, dans le plus grand nombre possible ; 2) Concession de primes en espèces, de 50 fr par 100 mûriers en état de production normale et destinés à l'élevage des vers à soie ; 3) Concession de primes de 25 fr par 100 mètres de mûriers dressés en espalier et par 100 pieds de mûrier plantés en lignes ; 4) Concession de 0,50 fr par kg de cocons frais produits

en Espagne ; 5) Concession de 0,25 fr par kg de cocons frais espagnols dévidés en Espagne.

Cette loi promulgue aussi les mesures suivantes : 1) Développement des Services officiels de sélection et de distribution de la graine de vers à soie, et de l'enseignement, stable ou ambulant, de la culture des mûriers et de l'élevage des vers à soie ; 2) Installation de pépinières des meilleures variétés de mûrier.

On élève à 4 fr or les droits de douane pour chaque kg de soie moulinée, et à 5 fr or pour chaque kg de soie moulinée et blanchie ou teinte, provenant de l'étranger.

Pour l'application des mesures promulguées dans cette loi, on a inscrit au budget, à partir de 1915, une somme de 840 000 fr.

## PISCICULTURE

354 - **Nouveau procédé de congélation pour la conservation des poissons.** — KALERT E., dans *Zeitschrift für Fleisch- und Milchhygiene*, 26<sup>ème</sup> Année, Fasc 23, pp. 353-355. Berlin, 1<sup>er</sup> Septembre 1916.

L'A. décrit le procédé inventé récemment par OTTESEN pour la conservation des poissons, déjà breveté dans un grand nombre d'Etats et éprouvé à fond en Allemagne. Il consiste à congeler les poissons en les plongeant dans une solution salée, fortement réfrigérée. L'idée d'employer une solution salée froide pour la congélation n'est pas nouvelle, il est vrai, mais OTTESEN lui a donné une forme utilisable dans la pratique. La plus grande difficulté était d'empêcher que le sel de la solution où sont plongés les poissons pénétrât dans ceux-ci. OTTESEN a évité cet inconvénient en employant une solution de sel encore très éloignée du point de saturation lorsqu'elle est abaissée à la température de congélation (- 15° C). Une telle solution ne peut pas céder de sel aux poissons que l'on y plonge ; elle possède au contraire la faculté d'absorber elle-même encore du sel.

Une préréfrigération des poissons dans de l'eau glacée ou dans une glacière est cependant nécessaire, parce que : 1) Au moment où l'on plonge les poissons dans la solution, celle-ci se réchauffe au voisinage immédiat des poissons et reprend alors la faculté de leur céder du sel, aussi longtemps que solution et poissons sont de températures différentes ; 2) La congélation presque instantanée des couches extérieures des poissons plongés empêche le sel d'y pénétrer.

Les déterminations exactes de la teneur en sel chez plusieurs poissons congelés ont en outre montré qu'une quantité très minime de sel pénétrait dans la peau et la couche de viande immédiatement adjacente. On put constater dans ces parties de 0,24 à 0,42 % de Na Cl contre environ 0,1 % de teneur naturelle en sel. Des recherches analogues faites sur des poissons congelés dans une solution plus fortement concentrée indiquèrent, selon le degré de saturation, un taux de sel variant du double au sextuple. On reconnaît que le point de saturation de la solution n'est pas encore atteint à ce qu'il se forme sans cesse de la glace pure en masse blanche et neigeuse. L'espèce et la quantité de glace formée sont des points de repère utiles pour juger si la solution est à la concentration voulue.

L'appareil pour l'exécution du procédé est relativement très simple. La solution est placée dans un bassin isolé et agitée constamment et vigou-



reusement par un brassoir. Le froid nécessaire est transmis à la solution par un système de tuyaux réfrigérants ; la source de froid est une machine réfrigérante. La grandeur du bassin et de la machine est déterminée par la quantité de poissons à congeler.

Dans un bassin de 2 m<sup>3</sup> 100 quintaux de poissons peuvent être congelés en 24 heures. En outre, jusqu'au moment de leur emploi, les poissons congelés doivent être conservés dans des locaux où la température est abaissée à environ — 7° C.

Ce procédé présente de grands avantages et, selon l'A., il est appelé à transformer en plusieurs points la conservation des denrées alimentaires par le froid et à leur imprimer une nouvelle direction. Ces avantages sont les suivants : a) Toute perte de poids par évaporation d'eau est totalement évitée pendant la congélation ; b) Les poissons gardent un air de fraîcheur naturelle par suite de l'empêchement d'un dessèchement ; c) La congélation rapide épargne un temps et un espace considérables, et les tissus musculaires sont beaucoup moins altérés.

L'avantage économique réside particulièrement dans le fait que les marchés peuvent ainsi être régulièrement pourvus de poissons parfaitement frais, provenant même de localités de pêche très éloignées. Les appareils peuvent aussi être installés sur les navires.

L'A. se propose d'exposer plus tard les résultats des expériences encore en cours concernant l'application de ce procédé à la conservation de la viande.

355 - **L'ondatra musqué (*Fiber zibethicus*) nuisible aux poissons et aux oiseaux aquatiques en Bavière et en Bohême** (1). — KOFF G. et MATER H. N., Relation d'un voyage d'études sur l'ondatra en Bavière et en Bohême, dans *Allgemeine Fischerei-Zeitung*, 42<sup>ème</sup> Année, N° 3, pp. 33-37 ; N° 4, pp. 49-52. Munich, 1<sup>er</sup> et 15 Février 1917.

L'ondatra (2) s'est introduit en 1914 de Bohême en Bavière, et dès lors y a pris pied de plus en plus. Conscient des dangers de cette propagation, le Ministère bavarois de l'Intérieur a publié une ordonnance prescrivant aux Offices d'arrondissement de la Basse-Bavière, du Haut-Palatinat et de la Haute-Franconie de donner aux personnes ci-après désignées des instructions concernant l'ondatra, en leur enjoignant de le combattre et de communiquer leurs observations aux dits Offices : chasseurs — pêcheurs — propriétaires d'usines — employés des Services agronomiques, forestiers, douaniers, hydrauliques et de voirie. En même temps, la « Biologische Versuchs-Station für Fischerei » de Munich (Station d'essais biologiques de pisciculture) fut chargée d'organiser des essais de lutte contre l'ondatra, et le « Bayrischer Landesfischereiverein » (Société bavaroise de pisciculture) reçut d'importants crédits pour la distribution de primes de capture.

Jusqu'ici on n'a trouvé, ni en Amérique, ni en Bohême, ni en Bavière, aucun procédé permettant d'enrayer la propagation de l'ondatra. Aussi

(1) Voir aussi : B. 1915, N°s 242 et 417 — B. 1916, N° 215. (N. d. R.).

(2) Dit aussi vulgairement « rat musqué du Canada » et, par les Anglo-Américains, « musquash ». Cf. BREHM A. E., *Merveilles de la Nature, Les Mammifères*, édition française par Z. GERBE, Vol. II, p. 127. Paris, Librairie J. B. Baillière et fils. (N. d. R.).

décida-t-on de procéder tout d'abord à des observations sur la biologie de cet animal en vue d'acquérir de nouveaux principes permettant une lutte efficace, et le Ministère susdit en chargea une Commission composée du Prof. RÖRIG, membre de l'Institut impérial de Biologie de Dahlem - Berlin, et des D<sup>rs</sup> G. KORFF et H. N. MAIER (auteurs de l'article analysé). Cette Commission visita, dans l'automne de 1916 (du 13 au 20 octobre), les principales localités de Bavière et de Bohême où l'on capture des ondatras, et s'enquit sur place des avantages et des inconvénients des divers procédés de lutte.

Les 3 premiers jours, la Commission visita divers lieux de la Basse-Bavière et de la Bohême, mais sans pouvoir faire des observations importantes. Elle constata entre autres des restes d'ondatras dans des repaires de grands-ducs, ainsi qu'un squelette de perdrix dans un nid de ces rongeurs. A deux endroits on trouva des *Cysticercus fasciolaris* dans le foie de l'ondatra.

Le 4<sup>ème</sup> jour, la Commission visita la région de Frauenberg, où la propagation de l'ondatra est particulièrement forte. Une berge abrupte de rivière, qui n'aurait pas laissé supposer au profane la présence de ces rongeurs, se révéla l'habitat d'une véritable colonie, grâce au *flair d'un bon chien* (méthode à recommander). Les *fouilles* faites au premier nid permirent ensuite de prendre 8 ondatras. Toutefois les fouilles ont l'inconvénient de détériorer les digues et les berges plus encore que ne le font les galeries d'ondatras.

On essaya ensuite l'*enfumage* en introduisant, dans une galerie de sortie aboutissant sous l'eau, une cartouche de « citrocid » (de HINSBERG à Nackenheim s/Rhin) et en barrant les autres galeries au moyen de réseaux. Peu après l'introduction de la cartouche, les animaux apparaissaient, s'entraînaient dans les réseaux et pouvaient être pris vivants. Ce procédé parut à la Commission susceptible de donner d'assez bons résultats ; il présente le grand avantage de ne pas détériorer les digues et les berges, mais, pour son application en grand, lesdites cartouches sont relativement chères, aussi la Commission conseilla-t-elle de les remplacer par du papier ou des roseaux secs, qui donnèrent un résultat aussi bon. Au bout de 3 heures de travail, sur 200 mètres de berge, on captura 38 ondatras, pesant en tout 33 kg. On peut se représenter quels dégâts ils étaient capables de faire, toutefois, au dire des pêcheurs, les ondatras causeraient bien moins de pertes en détruisant directement les poissons qu'en les incommodant de leur présence, en hiver, et en les privant ainsi de tout repos.

Pour donner une idée de la multiplication effrayante des ondatras, on peut mentionner la trouvaille fréquente de plusieurs portées dans un même nid ; on a même trouvé une femelle allaitant encore et déjà pleine.

La Commission termina la 4<sup>ème</sup> journée par un repas à base de viande d'ondatra, et put confirmer la réputation qu'elle a déjà acquise en Amérique.

Le 5<sup>ème</sup> jour, la Commission visita les étangs de M. VON HILDRPRANDT à Blatna, et y étudia attentivement le fonctionnement du *tonneau-trappe flottant*, qui a déjà fait ses preuves dans la patrie de l'ondatra. C'est un tonneau à moitié plein d'eau, à gros trou de bonde carré, à extrémités bordées de planches larges d'environ 1 pied flottant sur l'eau et l'empêchant de tourner, qui fonctionne de la façon suivante : dans leurs parours à la nage les



ondatras, qui cherchent de temps en temps à se reposer sur un objet flottant, se juchent volontiers sur la bordure de planches, puis cherchent une cachette à l'intérieur du tonneau et s'y noient. Pour mieux les attirer, on met dans le tonneau un appât composé de panais ou de carottes, et l'on a soin d'y renouveler l'eau chaque jour. A Blatna ce système donne de très bons résultats : ainsi, on a capturé en 1 mois une trentaine d'ondatras, et il y eut même une nuit où il n'en tomba pas moins de 8 dans le tonneau.

Le 6<sup>ème</sup> jour, la Commission se rendit à Schlüsselburg, où l'ondatra a fait sa première apparition en 1908. Trois ans plus tard (1911), on comptait déjà 10 de ces animaux, en 1913 environ 300 et, en 1916, plus de 1 000. Les dégâts causés aux poissons n'étaient pas énorme : une seule fois on put constater, à l'occasion d'une pêche, que les ondatras avaient dévoré la tête à une centaine d'alevins de carpes (en une nuit), et une autre fois ils attaquèrent une carpe qui était venue frayer sur la rive. Par contre, les dommages causés aux constructions des étangs étaient beaucoup plus importants. Comme matériel de remplissage destiné à empêcher les ondatras de pénétrer dans les digues et les talus des étangs, c'est le mâchefer qui s'est montré le meilleur. Dans un étang les tonneaux-trappes n'avaient pas rendu de grands services, les ondatras ayant recouvert de roseaux les trous de bonde et transformé ainsi les pièges en châteaux flottants. Dans un étang beaucoup plus grand on avait constaté que, depuis l'apparition des ondatras, les oiseaux aquatiques autrefois si nombreux étaient en forte diminution ; on put aussi établir que ces rongeurs, après avoir détruit les œufs et les jeunes, prenaient possession des nids flottants des oiseaux aquatiques et les affectaient à leur propre usage ; en outre ils dévoraient les poules d'eau.

D'autre part, les ondatras avaient fortement endommagé une oseraie atterante à l'étang en y rongean les tiges au point de donner à toute la plantation l'aspect d'un champ couvert de chaumes.

## GÉNIE RURAL.

356 — **Perfectionnements à la motocharrue Galardi-Patuzzo.** — TARCHETTI A., dans *Il Giornale di Riscicoltura*, VI<sup>ème</sup> Année, N<sup>o</sup> 23, pp. 353-356, 2 fig. Vercelli, 15 Décembre 1916.

MACHINES  
AGRICOLES

Le nouveau type de motocharrue GALARDI-PATUZZO (Vérone, Italie), expérimenté avec succès dans les essais de labourage en rizière faits en novembre 1916 à Ponzana (province de Novare, Italie), sous les auspices de la Station d'essais rizicoles de Vercelli, ne diffère pas, pour l'ensemble et les dimensions, du type présenté une année auparavant (1). Toutefois quelques modifications en ont sensiblement amélioré le fonctionnement en permettant :

- 1) de diriger plus facilement la machine, indépendamment plus ou moins de la forme et de la position des corps de charrue ;
- 2) de régler plus commodément les corps de charrue et leur travail ;

(1) Voir B. 1915, N<sup>o</sup> 1074.

(N. d. R.).



3) d'obtenir plus rapidement la mise en œuvre, et aussi l'inverse pour retourner sur route.

Pour faciliter la direction, on a augmenté le jeu entre l'âge des corps de charrue et le reste de la machine, soit en espaçant les 2 crochets qui attachent la fourchette de l'âge au châssis, soit en remplaçant le tourillon (qui auparavant reliait l'âge à l'extrémité inférieure de la barre verticale perforée servant à régler la hauteur des corps de charrue) par une poulie pouvant glisser sur un guide horizontal attaché en prolongement de l'âge.

Cette augmentation du jeu facilite beaucoup la manœuvre des barres d'attache, car leur déplacement acquiert une certaine amplitude, indépendamment de la position de l'âge et, par conséquent, des corps de charrue, c'est-à-dire sans qu'il faille presser sur ceux-ci enterrés, comme on devait le faire précédemment pour obtenir rapidement de forts changements de direction.

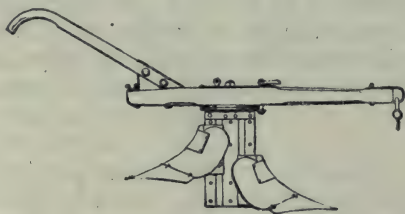
Cette indépendance de mouvement entre puissance et résistance présente un autre avantage considérable pour les applications en rizière : elle permet d'allonger ou de modifier l'âge presque à volonté, et par suite d'appliquer commodément aussi les avant-socs, qui ne trouvaient pas place dans les premiers types à attache semi-rigide.

Pour rendre plus commode le réglage des corps de charrue, on fait maintenant les deux extrémités de la fourchette d'attache de l'âge réglables en hauteur au moyen d'une vis et d'une manivelle, en sorte que l'on peut soit relever, soit abaisser, soit incliner l'âge à volonté durant le travail, comme on le fait dans les charrues ordinaires à avant-train.

Une autre innovation consiste dans le système d'application des grappins d'adhérence : on a aboli les boulons, qu'on a remplacés par un simple mécanisme de leviers et de ressorts permettant de fixer tous les grappins en guère plus d'une minute et de les enlever tout aussi vite quand le labourage est terminé, pour les remplacer par autant de sabots de bois formant bandage de roue dans les trajets sur route et empêchant la boue de pénétrer dans les rainures du tambour.

357 - Charrue dos-à-dos avec âge rotatif de Dowling. — *Scientific American*, Vol. CXVI, N° 2, p. 68, 1 fig. New York, 13 Janvier 1917.

Cette machine, inventée par M. JOHN DOWLING, à Powell, Wyoming, États-Unis (brevet américain N° 1 206 517 (1), a 2 corps de charrue disposés



Charrue DOWLING.

(1) Voir *Revue des brevets*, dans *B. Mars* 1917, N° 275, p. 452.

(N. d. R.)

dos-à-dos contre l'étaçon. En faisant décrire un demi-tour à l'axe rotatif, on peut mettre en direction de labour soit l'un, soit l'autre ; comme ils sont montés séparément, on peut les faire glisser verticalement le long de l'étaçon soit dans le même sens, soit en sens opposés, de façon à élever l'un pendant qu'on abaisse l'autre en position de travail.

**358 - Tracteur Bates-Joliet avec commande de direction extensible. —**

FREMIER VICTOR, dans *Le Génie Rural*, 8<sup>ème</sup> année, Nouvelle Série N° 6 (N° 66), p. 10, 3 fig. Paris, 1916.

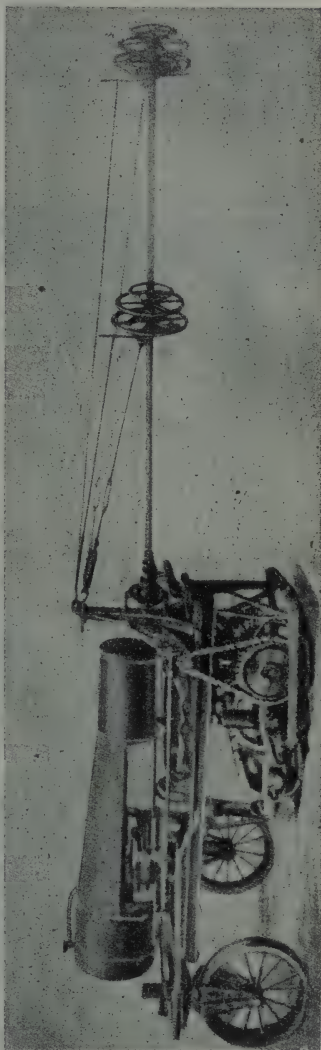
La JOLIET OIL TRACTOR COMPANY adapte, à l'arrière de ses tracteurs, un dispositif de direction extensible permettant au conducteur d'être assis derrière la charrue ou la lieuse et de s'occuper, en même temps que de la conduite du tracteur, de la manœuvre des appareils remorqués.

Le tracteur JOLIET présente aussi, comme détails de construction intéressants : des roues directrices extensibles, et, à l'arrière, une bande de roulement motrice unique. En cas de rencontre d'un obstacle, la partie antérieure de cette bande peut osciller autour de l'arbre du pignon de commande qui se trouve à l'arrière. Dans ce déplacement, la bande est guidée dans une coulisse verticale fixée sous les longerons du châssis.

La superficie de contact de la bande de roulement est d'environ 35 cm<sup>2</sup>, ce qui permet de donner au tracteur la résistance nécessaire pour tirer une charrue à 3 socs, labourant à 20 cm de profondeur. Pour augmenter son adhérence, la bande de roulement est pourvue d'un dispositif très ingénieux qui consiste à faire agir la barre de traction sur un levier articulé à sa partie supérieure aux longerons du châssis et disposé en diagonale sous celui-ci, de façon que l'extrémité inférieure du levier vienne presser sur l'axe du galet central de la bande.

*Moteur* : à 4 cylindres ; puissance à la barre d'attelage, 13 HP.

*2 vitesses* : 3 km et 5 km à l'heure.



Tracteur BATES-JOLIET avec sa commande de direction extensible.

*Poids* : 2 800 kg.

*Encombrement* : longueur 3,3 m ; largeur 2,5 m ; hauteur 1,8 m.

*Prix* (en Amérique) : moins de 5 000 fr.

359—**Marqueurs-plantoirs de pommes de terre**: 1) "Burgess"; 2) "Atherton's Simplex".

— *The Implement and Machinery Review*, Vol. 42, N° 502, pp. 1122-1123. Londres 1<sup>er</sup> Février 1917.

1) Le marqueur « Burgess » construit par la maison G. C. OGLE & Son, à Ripley, Derby (Angleterre), creuse les trous recevant les tuber-

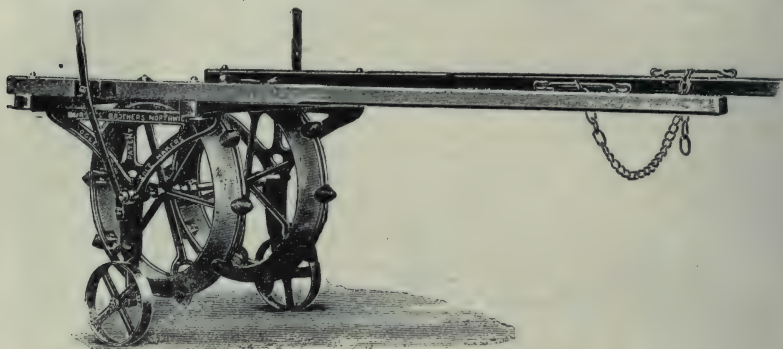


Fig. 1. — Marqueur-plautoir « Burgess ».

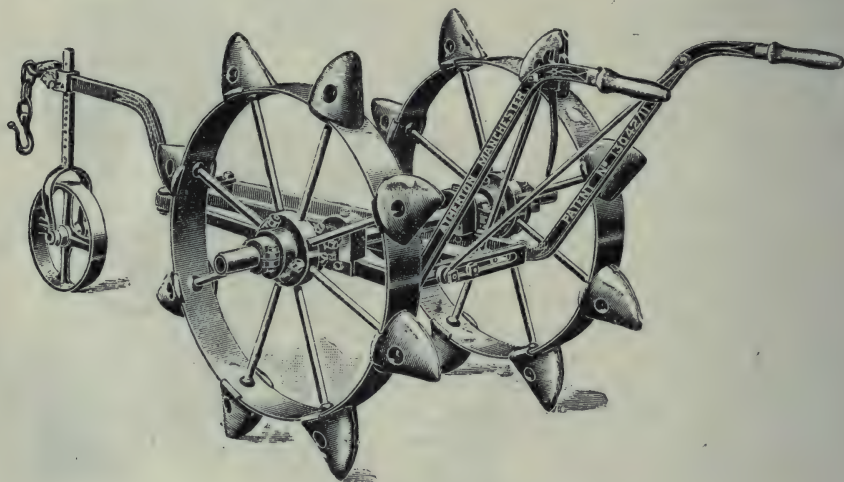


Fig. 2. — Marqueur-plautoir « Atherton's Simplex ».

cules de pomme de terre, au moyen de marqueurs portés par 2 roues dont la jante convexe presse la terre et l'empêche de recouvrir les trous formés. Les roues peuvent être mises à l'écartement voulu, et, sur les roues, les mar-

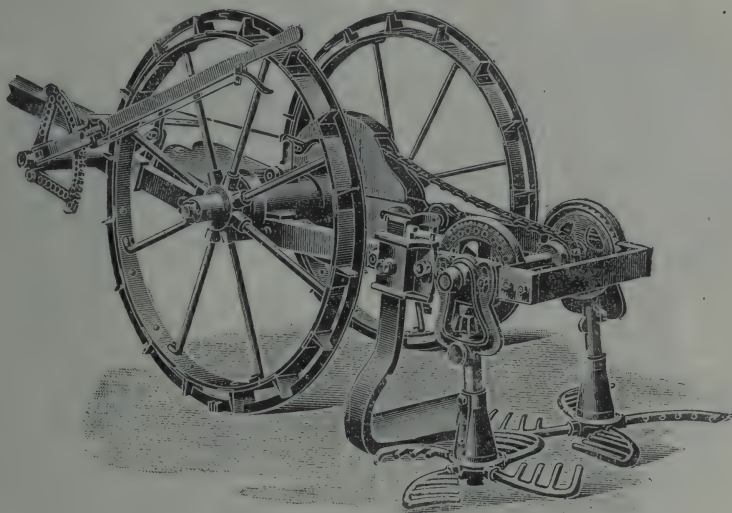


queurs peuvent être ajustés et fixés à la distance requise par la culture, grâce à la fente et à la cannelure dont la jante est pourvue.

2) Le marqueur « Atherton's Simplex », construit par M. W. ATHERTON, à Manchester, comporte un bâti (pouvant être transformé en houe à cheval ou en scarificateur) monté sur 2 roues à jante large portant les plantoirs. Ceux-ci sont formés de 2 pièces en acier, d'égale dimension, s'adaptant comme un étau sur les bords de la jante, sur laquelle ils peuvent glisser et se fixer de façon à creuser des trous distants de : 30 — 35 — 40 — 45 cm. Construit sans brancards ni timon, le marqueur peut tourner sur un espace limité.

360 — Arracheur de pommes de terre « Marvel ». — *The Implement and Machinery Review*, Vol. 42, N° 502, p. 1132, 1 fig. Londres, 1<sup>er</sup> Février 1917.

L'arracheur « Marvel », construit par la Firme A. BALLACH & SONS, à Edimbourg (Ecosse), possède comme organes actifs 2 moulinets à claire-voie, agissant horizontalement dans le sol et recevant le mouvement des roues à jante nervée par l'intermédiaire d'une chaîne à maillons détachables.



Arracheur de pommes de terre « Marvel ».

Les moulinets agissent comme des cribles rotatifs. Toutes les pommes de terre sont ramenées à la surface et projetées à 1 m environ.

Toutes les parties, ainsi que les moulinets arracheurs, sont à écartement, de façon à s'adapter aux conditions de sol et de culture.

361 — Séchoirs à grains employés actuellement en Allemagne. — Voir N° 373 de ce Bulletin.

362 - **Nouvelle machine à peler les agrumes inventée aux États-Unis.** — HOOD S. C., dans *United States Department of Agriculture, Bulletin* N° 399, pp. 13-19, fig. 6-10. Washington, 16 Décembre 1916.

Machine construite, à l'usage du public, par les soins du Département de l'Agriculture des États-Unis, où elle est brevetée sous le N° 1 186 317.

*Machine à peler les agrumes.*

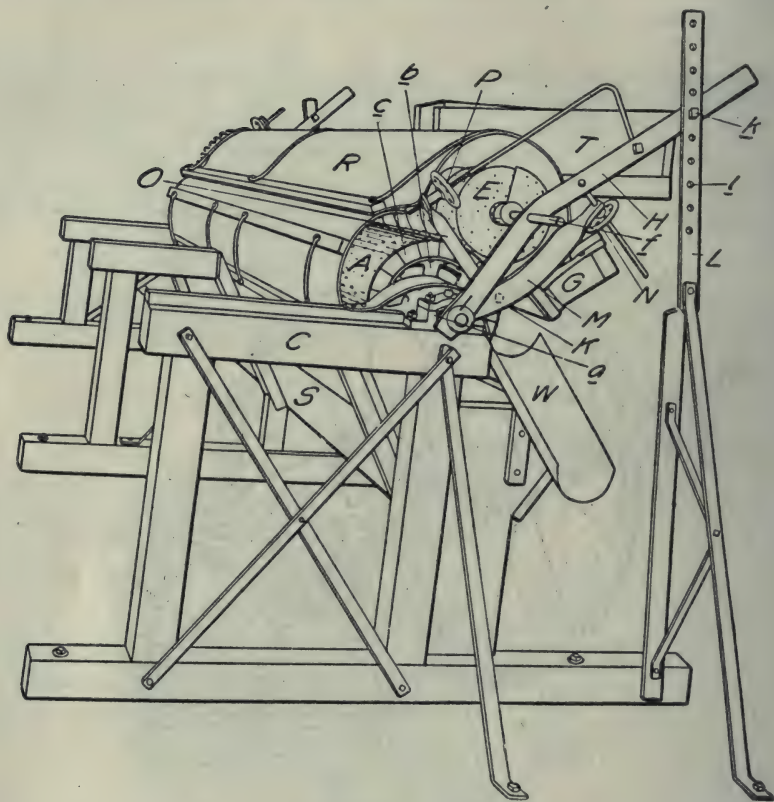


Fig. 1. — Vue perspective.

Des essais répétés faits à Orlando, Floride, ont montré qu'elle permet à 1 ouvrier de peler en 1 heure environ 1 800 kg d'oranges ou 3 200 kg de pamplemousses. La couche externe de l'écorce sort de la machine sous forme de pellicule très fine se prêtant particulièrement bien à l'extraction de l'huile essentielle, tandis que le fruit pelé est livré en conditions facilitant son emploi pour la préparation de divers produits alimentaires. D'autre part, il n'est pas nécessaire de trier les fruits avant de les mettre dans la machine.

DESCRIPTION DE LA MACHINE. — Les 4 parties essentielles en sont :

- 1) Un tambour à rotation rapide destiné à enlever la couche superficielle de l'écorce en grattant les fruits.
- 2) Une vis sans fin d'alimentation destinée à transporter les fruits le long du tambour en les faisant tourner d'arrière en avant, de façon que la pelure soit éliminée sous forme de spirale.
- 3) Une table d'alimentation de construction spéciale servant à soutenir les fruits pendant qu'ils passent à travers la machine.
- 4) Un mécanisme de réglage servant à modifier les positions relatives du tambour, de l'hélice d'alimentation et de la table, suivant les catégories de fruits à traiter et suivant leur degré de maturité.

Les détails de construction de cette machine sont représentés dans les 4 figures ci-jointes, où les lettres ont partout la même signification. La fig. 1

*Machine à peler les agrumes.*

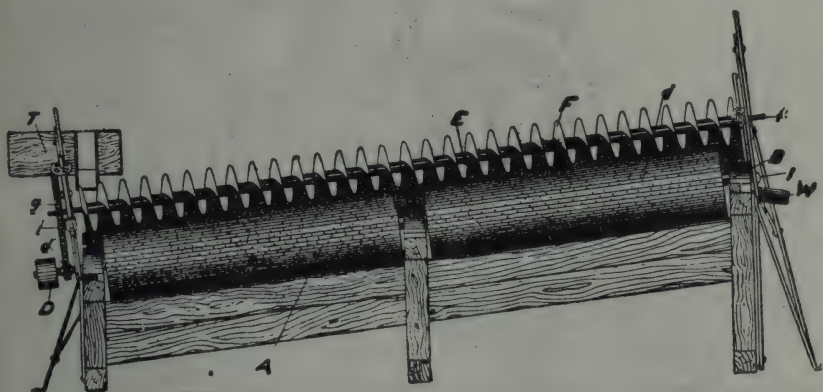


Fig. 2. — Vue longitudinale de la machine sans son couvercle, montrant la disposition du tambour et de l'hélice d'alimentation.

montre la machine en perspective dans toute sa longueur ; la fig. 2 la représente en long sans son couvercle, de façon à montrer la disposition du tambour et de l'hélice d'alimentation ; la fig. 3 est une coupe transversale ; la fig. 4 montre la face supérieure de la table d'alimentation.

*Le tambour A* (figg. 1 - 2 - 3) se compose de 2 tronçons longs chacun de 115 cm, et non d'une seule pièce, parce que, dans ce cas, il tend à se courber au milieu et à produire ainsi de fortes vibrations quand il tourne à la vitesse nécessaire. Chaque tronçon est formé de douves larges de 50,8 mm, épaisses de 38,1 mm, boulonnées à 3 roues de fonte mesurant 254 mm de diamètre et 76,2 mm d'épaisseur, dont une au milieu et une à chaque extrémité, montées sur un arbre d'environ 30 mm de diamètre. Les 2 tronçons du tambour sont séparés par un intervalle de 152,4 mm livrant passage au montant central du bâti. Quand toutes les douves sont assujetties, le tambour est soumis au tournage, soit sur un tour, soit en place sur le bâti.



La surface grattante du tambour se compose de bandes de tôle galvanisée N° 24, larges de 101,6 mm, poinçonnées à l'aide d'un poinçon triangulaire terminé en biseau de façon à obtenir les dents de râpe nécessaires. Ces dents

*Machine à peler les agrumes.*

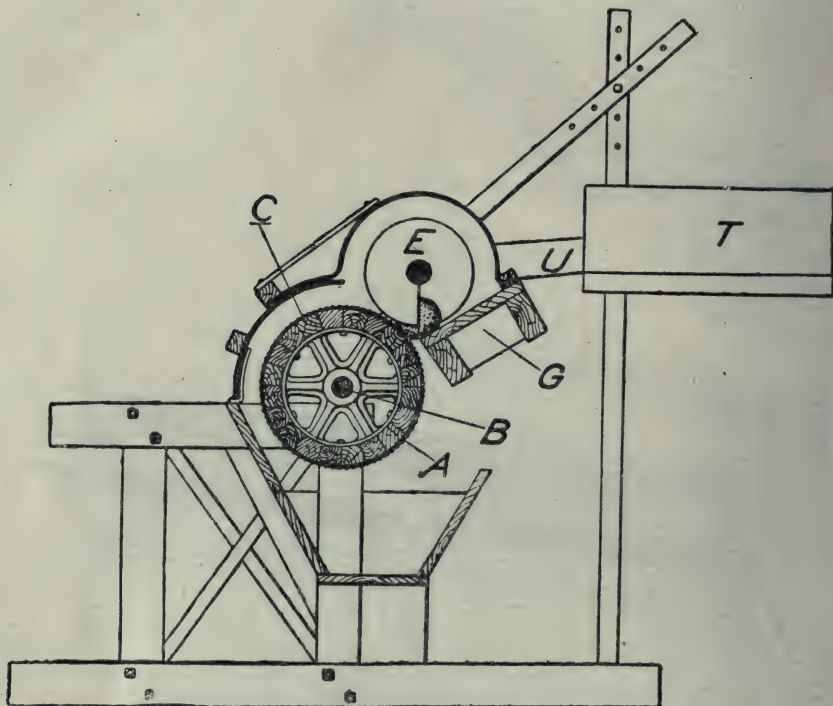


Fig. 3. — Coupe transversale.



Fig. 4. — Face supérieure de la table d'alimentation.

longues de 4,8 à 6,3 mm et formant une saillie de 2,4 à 3,2 mm, sont placées en carré, à intervalles de 18,9 mm, avec la pointe dirigée dans le sens de rotation du tambour. Autour de celui-ci les bandes de tôle sont enroulées en spirale de façon à le couvrir entièrement, puis fixées au moyen de clous N° 3

espacés d'environ 25 mm, en veillant à ce que ni leurs bords, ni leurs angles, ne forment des saillies capables d'endommager les fruits.

Le *bâti*, représenté dans les figg. 1 et 2, se compose de barres de bois carrées (101,6 × 101,6 mm) assemblées à mortaise et convenablement reliées par des croisillons de fer. Au bout inférieur, il mesure 508 mm de hauteur et, au bout supérieur, 813 mm. Il est vissé au sol et les bouts sont soutenus par des étais de fer également vissés à celui-ci.

La *vis d'alimentation E* (figg. 1 - 2 - 3), de même longueur que le tambour, se compose d'un arbre tubulaire en fer galvanisé sur lequel est soudée une spirale en tôle galvanisée de calibre 22, avec filet haut d'environ 89 mm incliné en avant de 15°, et pas mesurant 101,6 mm de largeur. Les faces de la spirale sont couvertes d'un poinçonnage serré fait au poinçon triangulaire de façon à former sur la face postérieure des pointes hautes d'environ 3,2 mm. Cette vis repose sur des tronçons d'arbre mesurant 19 mm de diamètre engagés chacun de 60 cm dans les manchons d'accouplement vissés à l'intérieur de l'arbre tubulaire, à ses deux extrémités.

La *table d'alimentation G* (figg. 1-3-4), placée sous la vis d'alimentation tout le long de la machine, a un châssis de fer ou de bois large de 241 mm, couvert d'un plateau large de 254 mm divisé en sections (fig. 4) pouvant être à volonté fixées au bord externe du châssis ou bien enlevées. La face supérieure de ces sections est couverte de tôle galvanisée munie de dents analogues à celles du filet de la vis d'alimentation, mais plus petites.

Le *mécanisme de réglage E* (fig. 1) est soutenu à chaque bout par une barre de fer *H* fixée en bas à un collier à coussinet de métal blanc monté sur l'arbre du tambour, tandis que l'extrémité supérieure, percée d'une série de trous, est fixée par un boulon à une barre de fer verticale *L*, également trouée en série. Le trou (palier) de la barre *H* qui est traversé par l'arbre *f* de la vis d'alimentation doit se trouver en un point tel que, quand la vis est en place, il y ait environ 12,7 mm d'intervalle entre le bord de son filet et le tambour; en cas de fort travail, ledit palier doit être garni de métal blanc, pour empêcher l'usure. Quant au bras court *M*, il est fixé en bas au même collier que le bras *H*, tandis que son extrémité supérieure repose sur le volant-écrou *N*, qui peut tourner sur l'axe fixé à la partie supérieure du bras *H*, et permet d'élever ou d'abaisser le bout extérieur du bras *M*.

La table d'alimentation est soutenue par un bras de fer attaché en dessous, qui maintient en place les parties du châssis; ce bras atteint la face supérieure de la table et s'y replie à angle droit dans le même plan; au point *K*, il est assujéti par un boulon au bras *M*, puis il se replie à angle droit pour former le levier *O*, dont l'extrémité supérieure s'appuie contre le volant-écrou *P*. Celui-ci permet de modifier l'inclinaison de la table d'alimentation, qui pivote sur le boulon *K*; il importe que ce boulon soit dans le même plan que la surface du tambour, et disposé de façon que le bord interne de la face supérieure de la table d'alimentation soit écarté du tambour d'environ 9,5 mm.

L'arbre du tambour est muni d'une poulie ayant 203 mm de largeur à la couronne et un diamètre permettant d'imprimer au tambour une vitesse de 600 tours par minute.

La vis d'alimentation est munie d'une grande roue dentée à chaîne actionnée par un petit pignon à chaîne monté sur l'arbre du tambour et de dimension propre à lui imprimer 150 tours par minute.

Le *réceptif collecteur des râpures* est une auge en fer-blanc ou en tôle galvanisée placée sous le tambour, un peu au-dessus du niveau du sol. Le haut de sa paroi antérieure arrive en-deçà du bord interne de la table d'alimentation, tandis que sa paroi postérieure dépasse le tambour et atteint le haut du bâti, où elle est reliée à des couvercles amovibles, enfermant complètement le tambour et la vis d'alimentation. Ces deux organes peuvent être facilement enlevés pour le nettoyage.

**MANŒUVRE DE LA MACHINE.** — Les fruits à peler sont mis dans le caisson *T* (figg. 1 - 2 - 3), dont le fond domine de plusieurs centimètres le tambour à son bout inférieur et communique, par la goulotte de décharge *U* (fig. 3), avec le bord de la table d'alimentation. Les fruits roulent dans cette goulotte et sont placés à la main, un à un, entre les deux premiers tours de spire de la vis d'alimentation (fig. 3), à chaque révolution de celle-ci. Chaque fruit est alors transporté de bas en haut tout le long de la machine, au contact du tambour, qui en enlève l'épiderme en le grattant ; sitôt qu'il vient à toucher le tambour tournant vite, il tend à rouler rapidement en sens inverse, mais ce mouvement est suffisamment retardé par la surface dentée de la table, qui le soutient, en sorte qu'il subit l'action des dents du tambour. Le filet denté de la vis d'alimentation tend à faire rouler le fruit en avant sur la table, en sorte que l'épiderme est éliminé en une série de spirales. Les fruits pelés sont déchargés par la gouttière *W* (figg. 1 et 2).

Quand on règle la machine pour le travail, on peut modifier la gravitation des fruits contre le tambour en élevant ou en abaissant le bras *H* sur la barre *L*, (fig. 1). Au moyen du volant-écrou *P* on peut incliner plus ou moins la table d'alimentation, de façon à augmenter ou diminuer l'angle qu'elle fait avec le tambour. Plus cet angle devient petit, plus le fruit tend à être pressé contre le tambour et à y être gratté.

En élevant ou en abaissant le bras *M* au moyen du volant-écrou *N*, on peut régler la distance entre la table et la vis d'alimentation.

**MODIFICATIONS DE LA MACHINE REQUISES PAR LES DIVERS AGRUMES.** — Les dimensions susdites sont celles qui conviennent pour oranges ou citrons. Pour peler les pamplemousses, il faut employer une vis d'alimentation plus longue et à pas plus large ; pour les limettes, on adoptera au contraire une vis plus courte et à pas plus étroit.

363 - **Camions à caisson basculant.** — *The Implement and Machinery Review*, Vol. 42, N° 502, p. 1131, 2 fig. Londres, 1<sup>er</sup> Février 1917.

La construction des chariots et camions a fait, ces dernières années, de grands progrès. Ainsi, la F<sup>me</sup> RUSTON, PROCTOR & Co. Ltd., à Lincoln (Angleterre), fournit 2 types de camions pouvant intéresser les agriculteurs et tous ceux qui s'occupent de transport, l'un à caisson basculant de côté, l'autre à caisson basculant en arrière.

Le premier (fig. 1) peut être manié par un seul homme alors même qu'il porte pleine charge. Pendant le mouvement de bascule du caisson pour sa décharge, le côté servant de cloison reste en position normale. Le



déchargement se fait aisément, sans requérir de pelletage à bras ; il suffit de faire avancer quelque peu le chariot.



Fig. 1. — Camion RUSTON, PROCTOR & Co. à caisson basculant de côté.

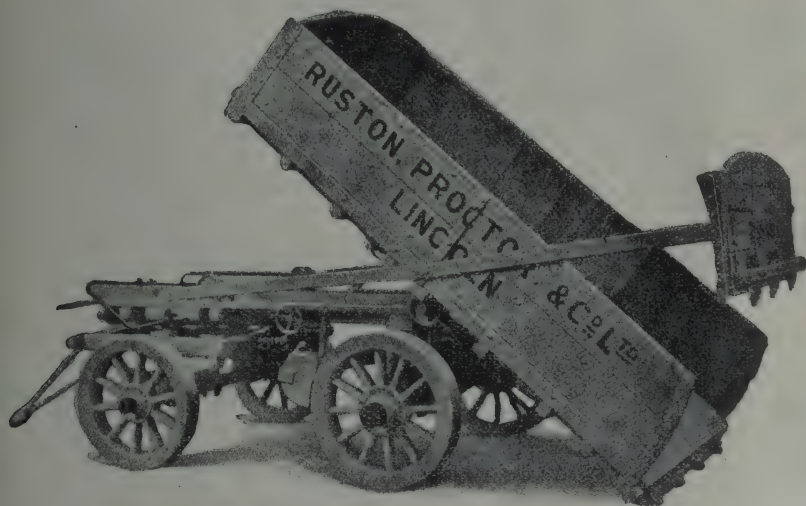


Fig. 2. — Camion RUSTON, PROCTOR & Co. à caisson basculant en arrière.

Le second modèle, basculant en arrière (fig. 2), peut décharger la plus lourde charge en  $1\frac{1}{2}$  minute. Le mouvement de bascule s'obtient au moyen

d'une manivelle placée au-dessus d'une des roues d'avant. Comme dans le premier type, la cloison d'arrière reste en position normale pendant que le caisson bascule, fonctionnement que la figure permet de saisir aisément.

### 364 - Revue des brevets.

#### *Préparation du sol.*

Canada	172 252	Fossoyeuse-niveleuse pour routes.
	172 272	Herse.
	172 292	Dispositif de cultivateur.
	172 300	Machine aratoire.
	172 331	Fossoyeuse.
Etats-Unis	172 653	Lame à couper la terre.
	1 210 511	Moto-cultivateur.
	1 210 795	Herse.
	1 210 901	Accessoire de charrue.
	1 211 241	Machine aratoire.
	1 211 358	Accessoire de herse.
	1 211 565	Tracteur pour charrues.
Inde britannique	1 211 968	Palonniers pour charrues.
	2 758	Accessoire de charrue émiettant la terre.
Royaume-Uni	101 993 — 102 756	Cultivateurs.
	102 890	Charrue.

#### *Fertilisation du sol.*

Canada	172 242	Engrais chimique (mélange de : cyanamide de calcium, sulfate d'ammoniaque et superphosphate).
Etats-Unis	1 210 636	Distributeur d'engrais.
	1 211 836	Distributeur d'engrais accessoire pour semoirs.
Royaume-Uni	14 662 — 14 663	Procédés de fabrication de la cyanamide de calcium.
	102 493	Procédé de fabrication d'engrais potassiques.
Suisse	74 586	Chariot à purin (« lisier »).

#### *Ensemencement et plantation.*

Canada	172 286	Semoir.
Etats-Unis	1 211 004 — 1 211 265	Marqueurs pour semois à maïs.
	1 211 365	Semoir à maïs.
	1 211 596 — 1 211 603	Semoirs.
	1 211 929	Semoir en lignes.
	1 211 861	Plantoir de pommes de terre.

#### *Soins culturaux.*

Canada	172 434	Sécateur.
	172 551	Sarcluse.
Royaume-Uni	102 760	Sécateur.

#### *Lutte contre les maladies et ennemis des plantes.*

Canada	172 516	Piège à phalènes.
	172 685	Attrape-mouches.
Royaume-Uni	14 902	Piège à insectes.
	15 256	Piège à animaux.

*Récolte des fourrages, céréales, etc.*

- Canada 172 185 Mécanisme de moissonneuse.  
 172 211 Moissonneuse à fèves.  
 172 267 — 172 268 — 172 835 Moissonneuses.  
 172 329 — 172 749 Machines à faire les moyettes (moyetteuses).  
 172 762 Moissonneuse-batteuse.
- Etats-Unis 1 210 958 Machine à récolter le coton.  
 1 211 100 Moissonneuse à maïs.  
 1 211 627 Appareil lieur de gerbes pour moissonneuse.  
 1 211 880 Machine à faire les moyettes (moyetteuse).  
 1 211 972 Moissonneuse.  
 1 212 011 Plate-forme à toile sans fin pour moissonneuse-lieuse.  
 1 212 044 Râteau et presse à foin combinés.  
 1 212 058 Machine à récolter les graines de graminées fourragères.  
 1 212 061 Machine à récolter fèves et pois.
- Royaume-Uni 13 029 Faneuse.  
 15 293 Machine à récolter le lin.
- Suisse 74 587 Faucheuse.

*Récolte des tubercules et racines.*

- Canada 172 443 Machine à récolter les betteraves.
- Etats-Unis 1 211 030 Machine à récolter les betteraves.
- Royaume-Uni 14 737 Machine à récolter les racines.

*Battage, nettoyage et triage des grains et semences.*

- Canada 172 404 — 172 637 — 172 726 Mécanismes de batteuse.  
 172 651 Séparateur de folle avoine.  
 172 655 Trieur de grain.
- Royaume-Uni 15 243 Machine à écosser les pois.

*Transport, préparation et conservation des récoltes.*

- Canada 172 193 Voiture à transporter les gerbes.  
 172 271 Porte de chariot à grain.  
 172 338 — 172 339 — 172 340 — 172 582 Machines à décortiquer les arachides.  
 172 604 Camion basculant.  
 172 690 Fourgon à marchandises et à bétail.  
 172 711 Mécanisme pour séchage des fruits et légumes.  
 172 800 Séchoir à foin.  
 172 805 Appareil à tasser les fourrages dans les silos.  
 172 828 Chariot avec monte-gerbes.
- Etats-Unis 1 210 393 Ameulonneuse pour foin.  
 1 212 094 Botteleuse pour foin.
- Royaume-Uni 14 899 — 14 900 — 14 963 Machines à casser les noix de palme.

*Sylviculture.*

- Canada 172 197 Machine pour abattre les arbres.

*Traction des machines agricoles.*

- Etats-Unis 1 211 216 Tracteur.  
 1 211 565 Tracteur pour charrues, etc.



*Entretien du bétail.*

- Canada 172 482 Dispositif pour dételer les chevaux.  
 172 535 Attache-queue pour vache.  
 Royaume-Uni 13 002 — 14 569 — 14 570 — 14 777 Fers à cheval.

*Aviculture.*

- Canada 172 164 Caisse pour le transport des œufs.  
 172 327 Couveuse.  
 172 436 — 172 646 Nids pour poules pondeuses.  
 172 490 Abreuvoir pour volaille.  
 172 515 Appareil à nourrir la volaille.  
 172 595 Eleveuse ou mère artificielle pour poussins.  
 172 648 Appareil à mirer les œufs.  
 172 919 Procédé pour la conservation des œufs.  
 Royaume-Uni 14 829 — 102 815 Aliments pour volaille.  
 102 653 Instrument pour marquer les œufs.

*Constructions rurales*

- Etats-Unis 1 211 643 Accessoire de moteur éolien.  
 Suisse 74 589 Caisse pour couche de forçage

*Industries des produits végétaux.*

- Canada 172 671 Procédé de fabrication d'un lait artificiel à base d'arachide.  
 172 817 Machine à broyer le chanvre.  
 Inde britannique 2 759 Traitement du jus de canne à sucre.

*Industrie laitière.*

- Canada 172 204 Appareil à refroidir le lait.  
 172 464 Baratte.  
 Etats-Unis 1 210 468 Machine à traire.  
 Royaume-Uni 14 575 — 14 592 Machines à traire.

*Divers.*

- Canada 172 625 Vase à fleurs.  
 172 856 — 172 904 Nettoie-bouteilles.  
 172 857 Machine à laver les bouteilles.

CONSTRUCTION  
RURALES.

365 — **Abreuvoir hygiénique à cuvettes distinctes, permettant à plusieurs chevaux de boire isolément.** — *Scientific American*, Vol. CXVI, N° 2, p. 66 + 1 fig. New-York, 13 Janvier 1917.

Pour prévenir la propagation de maladies parmi les chevaux, et surtout de la morve, si fréquente ces dernières années, on a inventé récemment aux États-Unis un système d'abreuvoir de sûreté empêchant ces animaux de boire plusieurs à la fois dans la même masse d'eau.

Cet abreuvoir contient quelques cuvettes juste suffisantes pour le museau de chaque animal, et où l'eau pénètre avec force par le fond pour s'écouler ensuite par dessus bord. Il y a donc un courant d'eau continu, dont l'excédent se déverse dans le bassin et de là gagne les conduites d'évacuation.

Un essai de ces abreuvoirs fait durant l'hiver de 1916 a montré qu'ils peuvent fonctionner par n'importe quel temps : ainsi, même à une température de  $-12^{\circ}$ , il ne se formait pas de glace dans les cuvettes ou dans le bassin.

## INDUSTRIES AGRICOLES.

366 - **Variation du degré glucométrique chez des moûts provenant des mêmes vignes en années diverses.** — MARESCALCHI A., dans *L'Italia vinicola ed agraria*, VII<sup>ème</sup> Année, N<sup>o</sup> 5, pp. 68-69. Casal Monferrato, 4 Février 1917.

Les données suivantes, recueillies par l'A. chez M. FRANCESCO MARCHESI, Directeur de la Cave Sociale formée par des propriétaires de vignes de Retorbido di Voghera dans la province de Pavie, viennent confirmer de façon très probante le fait, depuis longtemps connu dans la pratique, de l'énorme influence de l'année sur la composition des vins. Elles indiquent le degré glucométrique de raisins provenant *du même domaine, des mêmes vignes*, en années diverses, et montrent que, dans la même vigne, soignée de la même manière, par les mêmes propriétaires, l'alcool produit par le sucre présent dans le raisin peut varier jusqu'à 2,2 % d'une année à l'autre.

### Degré glucométrique du moût des mêmes vignes en années diverses.

Années	Vigne 1	Vigne 2	Vigne 3	Vigne 4 (plaine)
1909 . . . . .	16,7	17	18,2	17
1910 . . . . .	17,6	16	17	17,4
1911 . . . . .	17,1	16	18,6	16,6
1912 . . . . .	18,8	17,8	20,5	17,6
1913 . . . . .	18,7	16,9	18,4	18,5
1914 . . . . .	19,3	16,9	20	16,7
1915 . . . . .	19,8	18,8	19,9	18
1916 . . . . .	17,3	17	18,7	16
<i>Écarts maxima</i>	3,1	2,8	3,5	2,5

367 - **Sur la casse blanche des vins.** — FONZES-DIACON, dans *Comptes Rendus des Séances de l'Académie des Sciences*, Tome 164, N<sup>o</sup> 4, pp. 199-200. Paris, 22 Janvier 1917.

Dans une étude sur les casses des vins (Coulet éditeur, Montpellier, 1902), BOUFFARD signale une casse blanche caractérisée par un trouble laiteux, opalescent, se transformant en un dépôt blanchâtre. Cette casse résulterait d'une oxydation par l'air et se produirait malgré le chauffage, l'anhydride sulfureux et même l'acide tartrique ; la couleur du vin n'y prendrait pas part.

Selon BOUFFARD, le dépôt, formé de matières oxydées, paraît renfermer de la chaux, peut-être du fer. L'acide citrique seul empêche sa production.

Ayant eu à examiner un vin blanc fortement atteint d'une semblable casse, l'A. a pu déterminer la composition du dépôt obtenu par l'action d'un courant d'air prolongé.

INDUSTRIES  
DES PRODUITS  
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Ce dépôt blanchâtre qui, après dessiccation, est blanc grisâtre, renferme de la matière organique et des éléments minéraux ; la chaux y figure en très petite quantité, le fer y est en proportion plus élevée, et se trouve combiné à de l'acide phosphorique dans le rapport du phosphate ferrique basique  $\text{Fe}_2\text{O}_3 (\text{P}_2\text{O}_5)^2$ , dont MOISSAN signale la solubilité dans l'acide citrique.

Cette casse ne se produit que lorsque l'acide sulfureux, existant dans tout vin blanc, est oxydé ; le milieu n'étant plus réducteur, l'air agit sur le composé ferreux existant dans ce vin et le précipite sous forme de phosphate ferrique basique combiné à de la chaux et de la matière organique.

La chaux est indispensable à la formation de cette casse, car, si on la précipite en totalité ou en grande partie, le vin ne casse plus à l'air ; mais la proportion de chaux que renferment naturellement les vins blancs est toujours suffisante pour qu'elle puisse se produire.

Le fer et l'acide phosphorique en excès sont également indispensables, car on peut faire naître cette casse dans un vin blanc sain en l'additionnant de petites quantités de sulfate ferreux et de phosphate ammonique, puis provoquant l'oxydation par aspiration d'air ou par l'eau oxygénée.

L'emploi des solutions sulfureuses de phosphate ammonique, utilisées à l'heure actuelle en vinification pour remplacer le métabisulfite de potassium, paraît être une des causes les plus importantes de cette casse, qui se produit surtout dans les vins vinifiés en blanc, le matériel nécessaire à cette vinification mettant les moûts en contact avec une grande masse de fer.

L'A. poursuit l'étude plus approfondie de cette casse.

### 368 — La paraffine liquide pour remplacer l'huile d'olive dans les « fiaschi » de vin. —

GRIMALDI SIRO, dans *Bollettino dei Ministeri per l'Agricoltura e per l'Industria, il Commercio ed il Lavoro*, XV<sup>ème</sup> Année, Vol. II, Série B, Fasc. 5-8, pp. 47-49. Rome, Mai-Août 1917.

Dans des communications précédentes, l'A. a exposé que l'« huile jaune de paraffine », nommée aussi, dans le commerce : œnolium — œnoline — œnophylaxine — olivine — *paraffinum liquidum*, etc., se compose d'huile de paraffine colorée en jaune par de la tropéoline 000 ; que cette huile est employée pour la « soudure » du vin, (c'est-à-dire pour le couvrir dans les « fiaschi » (1), pour huiler les pièces de fromage Parmesan pendant la maturation, et aussi pour l'adultération de l'huile d'olive. En continuant ses recherches, l'A. a constaté que l'huile jaune de paraffine cède aux vins ainsi « soudés » la tropéoline qu'elle contient, aussi ces vins accusent-ils à l'analyse la présence d'un colorant artificiel, et ils sont exposés aux amendes et aux séquestres, même s'ils étaient à l'origine parfaitement purs. On déconseille donc vivement d'employer l'huile jaune de paraffine pour remplacer l'huile d'olive dans la « soudure » des vins.

(1) « Fiasco » (au pluriel « fiaschi ») = bouteille ventrue, à long col, garnie de paille, contenant un peu plus de 2 litres, usitée en Italie.



369 — **Le sorgho sucré et l'alcool de guerre, en France.** — POUZIN PAUL, dans *Journal d'Agriculture pratique*, 81<sup>ème</sup> Année, Nouvelle Série, Tome 30, N° 4, pp. 67-68. Paris, 22 Février 1917.

Après quelques considérations générales sur le sorgho sucré, l'A. rappelle que, vers 1860, sa culture, en vue de l'extraction du saccharose, avait pris une assez grande extension en France. A l'origine, on pensait que le sorgho sucré deviendrait la canne à sucre du midi de la France et l'on avait même monté des installations en vue de la fabrication du sucre. Malheureusement, dans le sorgho sucré, contrairement à la canne, la proportion de glucose atteint et dépasse même la moitié du sucre fermentescible total. Les entreprises étaient donc vouées à un échec.

Le même fait s'est produit il y a quelques années, en Amérique, lorsqu'on y a tenté d'utiliser le maïs cultivé d'une certaine façon (ablation de l'épi) pour le même objet.

Mais si le sorgho sucré n'a pas donné de résultats quant à l'extraction du saccharose, il pourrait être avantageusement cultivé pour la production de l'alcool ; il est même possible qu'une partie de l'alcool que la France achète aux Etats-Unis provienne du sorgho sucré, dont la culture s'est étendue pour la préparation des ensilages. D'après l'A., le rendement en jus avec un moulin simple est d'environ 60 %. La richesse saccharine du jus varie de 10 à 16 %. Le rendement en alcool pourrait atteindre au moins 5 % du poids des tiges, soit 20 hl à l'ha, pour une production de 40 000 kg, qui constitue, en culture principale visant à un usage industriel, une récolte pouvant être obtenue assez souvent.

Le prix de revient du sorgho sucré étant inférieur à celui de la betterave sucrière, son rendement en alcool reste comparable à celui de cette dernière.

La culture du sorgho ne porterait aucun préjudice à celle de la betterave ; elle pourrait se faire dans les régions où, faute de main-d'œuvre, d'habitude, ou de terrains convenables, cette dernière n'est pas cultivée. Le sorgho sucré permettrait tout au moins de diriger en sucrerie une petite partie des betteraves qui sans cela prendront le chemin des distilleries.

Des mesures devraient être prises pour mettre des graines, en quantité suffisante, à la disposition des cultivateurs.

Il est à noter que le vesou peut être traité dans les distilleries existantes ; l'A. croit qu'on pourrait retrouver en France des moulins à canne installés jadis pour l'extraction du jus du sorgho sucré.

370 — **Développement de la brasserie aux Etats-Unis pendant les 25 dernières années.** — RACH C., dans *The American Brewer*, Vol. 4, N° 1, pp. 20-23. New-York, Janvier 1917.

Le progrès de l'industrie du froid, pendant les dernières décennies, a rendu la brasserie indépendante de la marche des saisons et l'a libérée des coûteuses constructions de caves souterraines, en permettant ainsi aux grandes fabriques de s'agrandir rapidement pour produire davantage.

Le progrès énorme de l'agriculture américaine dans les 25 dernières années a assuré à cette industrie d'abondantes matières premières : orge, froment, maïs, riz et houblon, à des conditions avantageuses. L'augmentation constante du nombre des consommateurs, par suite de l'immigration,

a permis aux capitaux d'affluer largement dans cette industrie pour y profiter des conditions favorables à son développement. Les dividendes de 20 à 30 % obtenus par les premiers brasseurs ont diminué de la sorte peu à peu et ont fini par disparaître vers 1898. De 1890 à 1900, la production de la bière aux États-Unis augmenta de 27 à 40 millions de « *barrels* » (1) et, entre 1900 et 1910, de 40 à 60 millions de « *barrels* ». C'est durant cette période que se fondèrent les grandes brasseries de l'Ouest, en concurrence avec celles de l'Est, et que la vente de la bière en bouteilles directement au consommateur prit un énorme développement. De 1910 à 1914, la production augmenta encore, jusqu'à atteindre 66 189 473 « *barrels* » en 1914, mais ensuite elle s'abassa à 59 800 000 « *barrels* » en 1915, pour revenir enfin aux conditions normales en 1916.

En 1914, année de production maximum aux États-Unis, les 2 autres principaux états producteurs : Royaume-Uni et Allemagne, accusaient les données comparatives suivantes :

	Production	Nombre d'habitants	Consommation journalière par habitant
Etats-Unis. . . .	66 189 473 « <i>barrels</i> » (108 266 121 hl)	91 972 266	0,24 litre
Allemagne. . . .	54 807 530 « » ( 89 648 677 hl)	64 925 993	0,28 »
Royaume-Uni . .	50 590 170 « » ( 82 750 341 hl)	45 221 615	0,37 »

En 1914, 13 états de l'Union sur 47 fournirent 87,3 % de la production totale et, parmi eux, l'état de New-York produisit 21 %, la Pennsylvanie 12 %, l'Illinois 10,5 %, l'Ohio et le Wisconsin 8 % chacun, et le Missouri 6,4 %.

En 1916, il y avait en activité 1 328 brasseries, dont 307 possédant leurs propres malteries et 1 006 pourvues de l'installation nécessaire pour la mise en bouteilles ; on en fonda 10 nouvelles. L'examen des données statistiques disponibles, depuis 1891, montre que :

1) Le nombre total des brasseries a diminué constamment jusqu'en 1915 ; de 1 917 en 1891, il est descendu graduellement à 1 287 en 1914, puis remonté à 1 328 en 1916, tandis que la production augmente constamment.

2) Les brasseries possédant leur propre malterie diminuent en nombre ; elles représentaient le 36 % en 1891, et ne représentent plus que le 23 % en 1916 ; elles prédominent dans le Wisconsin et le Minnesota, états gros producteurs d'orge ; mais la production industrielle du malt s'est désormais imposée, par suite de l'introduction du procédé pneumatique.

3) Le nombre des brasseries pourvues d'installations pour la mise

(1) Le « U. S. beer barrel » (baril de bière des États-Unis) contient 163,57 litres.

(N. d. R.).



en bouteilles est monté de 34 % en 1891 à 80 % en 1915, et ce changement constitue un fait d'une importance capitale pour l'industrie de la bière aux Etats-Unis. Cette nouvelle orientation favorise la production en grand de bières bien fermentées, d'un type stable, capables de supporter le transport. Ces types de bières contiennent moins d'extrait et plus d'alcool que les bières en fûts, destinées à la consommation locale (« draught beers »).

L'A. se demande, à cet égard, si c'est la meilleure orientation à donner à la production, et si l'on ne doit pas, par contre, tenir compte que le caractère fondamental de la brasserie est d'être une industrie agricole, visant à transformer une partie des céréales en une boisson populaire, saine et nourrissante.

371 - **Nouvelles considérations sur l'examen du lait.** — GERÖ WILHELM, dans *Zeitschrift für Untersuchung der Nahrungs- und Genussmittel, sowie der Gebrauchsgegenstände*, Vol. 32, Fasc. 12, pp. 572-576. Münster i. W., 15 Décembre 1916.

INDUSTRIES  
DES PRODUITS  
ANIMAUX.

I. RELATIONS ENTRE LA RÉFRACTION ET LE POIDS SPÉCIFIQUE. — Pour l'examen du lait au point de vue du mouillage, la réfraction du sérum d'ACKERMANN au chlorure de calcium mérite certainement la plus grande attention. Après plusieurs années d'expériences, l'A. a pu établir que l'indice de réfraction du lait d'une vache descend rarement au-dessous de 38. Il y a un certain rapport entre le poids spécifique et la réfraction du lait mouillé. En soustrayant du degré de réfraction ( $R$ ) le poids spécifique exprimé en « degrés de lactodensimètre » ( $L$ ), on obtient un nombre à peu près constant, variant ordinairement entre 9 et 10. Au moyen de cette différence ( $R-L$ ), on peut déjà déterminer approximativement, lors de l'examen du poids spécifique, la quantité d'eau ajoutée au lait : si, p. ex.,  $R-L = 5$ , le lait a été mouillé à raison de 20 % d'eau.

Au moyen de la différence moyenne  $R-L = 10$ , on peut calculer approximativement le poids spécifique du lait caillé d'après la réfraction du sérum.

L'A. a observé, dans le lait des environs de Temesvar (Hongrie), que la réfraction du lait mouillé après caillage n'est que de 0,5 à 0,6 plus élevée que celle du lait normal. Donc, si l'on soustrait de la réfraction ( $R$ ) du lait mouillé 0,5, et si l'on diminue le chiffre de réfraction ainsi obtenu de 10 unités, on obtient à peu de chose près le poids spécifique du lait primitif.

II. APPRÉCIATION DU LAIT D'APRÈS SA TENEUR EN PETIT-LAIT. — L'A., ayant observé que le lait mouillé donne beaucoup plus de petit-lait que le lait normal, eut l'idée de juger la qualité du lait d'après la quantité de petit-lait. Des essais entrepris dans ce sens montrèrent que la quantité de petit-lait fournie par 100 cm<sup>3</sup> de lait normal varie généralement entre 59 et 65 cm<sup>3</sup>, rarement entre 65 et 68 cm<sup>3</sup>. Si la quantité de petit-lait dépasse 68 cm<sup>3</sup>, on peut en conclure que le lait a été mouillé. Or, on sait déjà que, dans les cas où la quantité de petit-lait dépasse 70 cm<sup>3</sup>, il est possible de déterminer, d'après les autres valeurs du lait, la quantité d'eau ajoutée, et l'on peut se demander s'il est vraiment nécessaire de déterminer la quantité de petit-lait. Selon l'A., cette détermination peut être précieuse sur-



tout quand il s'agit du lait d'une même vache, la réfraction pouvant suivant les circonstances s'écarter des conditions normales. Dans ce cas, il s'agit de savoir si le lait d'une même vache peut ou non contenir une quantité de petit-lait allant jusqu'à 68-70 cm<sup>3</sup>. Pour répondre à cette question, l'A. a examiné plusieurs échantillons de lait obtenus, à l'étable, surtout de vaches très productives ; jusqu'ici il n'a pu observer qu'un seul cas où la quantité indiquée ci-dessus ait été atteinte.

III. APPRÉCIATION DU LAIT D'APRÈS LE DEGRÉ D'ACIDITÉ. — L'A. a observé, il y a déjà très longtemps, que le degré d'acidité déterminé suivant le procédé de THÖRNER (1) est beaucoup plus bas dans le lait mouillé que dans le lait pur. Dans le lait de consommation qu'il a analysé, le degré d'acidité variait entre 17 et 22 ; dans le lait mouillé, il descend au-dessous de 15 si la quantité d'eau ajoutée est petite, et même au-dessous de 11-13 si la quantité d'eau est plus grande. Il faut remarquer que ces chiffres ne s'appliquent qu'à des échantillons de lait pris et analysés le matin.

En se basant sur le degré d'acidité, on peut facilement reconnaître les échantillons de lait suspect en procédant comme suit : A un mélange de 10 cm<sup>3</sup> de lait + 20 cm<sup>3</sup> d'eau distillée on ajoute 1,5 cm<sup>3</sup> de soude caustique N/10 colorée avec de la phénolphthaléine (1,5 cm<sup>3</sup> corresp. à 15 degrés d'acidité) ; le lait normal décolore la base parce que son degré d'acidité dépasse 15, tandis que le lait mouillé ne décolore pas la base.

En résumé, l'A. pense que la réfraction, le degré d'acidité et la quantité de petit-lait permettent bien de juger le lait d'une même vache et rendent souvent superflue la prise d'échantillons à l'étable.

372 - **Données générales sur les fromages fabriqués à la Station royale d'essais de fromagerie de Lodi (Italie) pendant l'exercice 1915-1916.** — BESANA C., dans *Annuario della R. Stazione Sperimentale di Caseificio di Lodi*, Année 1915, pp. 11-14. Lodi, 1916.

Pendant l'année de production fromagère 23 avril 1915—23 avril 1916, la « R. Stazione Sperimentale di Caseificio » de Lodi a reçu 1 346,7 hl de lait, représentant une moyenne journalière de 3,68 hl de lait mis en œuvre. Le prix du lait a varié de 16,2 à 16,6 fr l'hectolitre, porté et mesuré au dépôt de fromage de la gare. Les fromages fabriqués pendant l'année comprennent 4 fromages de lait entier : « Stracchino Quartirolo », « Crescenza », « Gorgonzola », « Provolone » ; 4 fromages de lait partiellement écrémé : « Caciocavallo », « Grana uso Reggiano », « Grana Lodigiano », « Gruyère uso Svizzero » ; 1 fromage de lait écrémé à la centrifuge : « Svedese » (suédois). Les données principales concernant le rendement en fromage frais et en fromage mûr, en beurre de crème et en beurre de petit-lait, sont réunies dans le Tableau ci-joint.

(1) Un mélange de 10 cm<sup>3</sup> de lait + 20 cm<sup>3</sup> d'eau est titré avec de la soude caustique N/10, et l'acidité trouvée est rapportée à 100 cm<sup>3</sup> de lait.

Rendements en fromage et en beurre obtenus à la Station de Lodi en 1915-1916.

	Fromages de lait entier				Fromages de lait partiellement écrémé					Fromages de lait écrémé à la centrifuge
	Stracchino Quartirola	Crescenza	Gorgonzola	Provolone	Cacio cavallo	Grana uso Reggiano	Grana uso Lodigiano	Gruyère uso Svizzero	Svedese (Suédois)	
Nombre de pièces . . . . .	551	413	79	93	576	168	19	22	24	
Poids moyen de chaque pièce au bout de 24 heures . . . . .	2,30 kg	2,18 kg	11,78 kg	2,50 kg	2,05 kg	21,28 kg	28,20 kg	23,00 kg	12,12 kg	
Poids moyen de chaque pièce, après maturation . . . . .	2,09 kg	2,01 kg	10,02 kg	2,01 kg	1,65 kg	19,24 kg	26,00 kg	20,53 kg	10,81 kg	
Perte moyenne de poids après ma- turation . . . . .	12,18 %	9,12 %	15,20 %	12,40 %	19,90 %	9,54 %	7,94 %	10,80 %	10,99 %	
Rendement moyen en fromage frais, en % du lait entier . . . . .	15,62 %	17,50 %	14,10 %	10,30 %	8,27 %	6,42 %	6,30 %	7,63 %	5,36 %	
Rendement moyen en fromage mûr, en % du lait entier . . . . .	13,83 %	16,08 %	12,03 %	9,04 %	6,56 %	5,86 %	5,76 %	6,79 %	4,78 %	
Rendement moyen en beurre de pe- tit-lait, en % du lait entier . . . . .	0,23 %	0,20 %	0,22 %	0,55 %	0,33 %	—	—	0,50 %	—	
Rendement moyen en beurre de crème, en % du lait entier . . . . .	—	—	—	—	1,48 %	2,81 %	2,67 %	1,85 %	3,90 %	

373 - Le séchage des grains en Allemagne. — STETEFELD RICHARD, dans *Die Mühle*, 53<sup>ème</sup> Année, N° 45, pp. 739-740, 2 fig. Leipzig, 10 Novembre 1916.

Les installations établies depuis peu en Allemagne pour le séchage des céréales fonctionnent d'après le principe de la circulation du grain dans

*Séchoir à grain employé actuellement en Allemagne.*

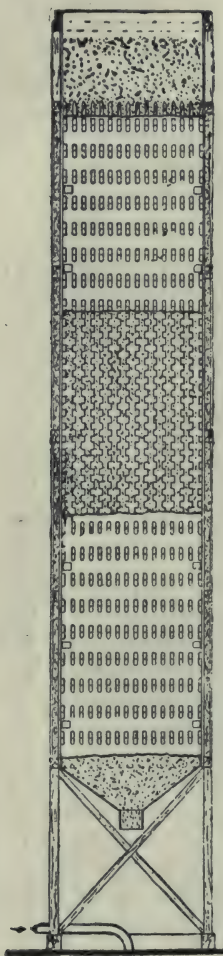


Fig. 1. — Coupe verticale montrant les canaux d'aération qui traversent la masse de grain.

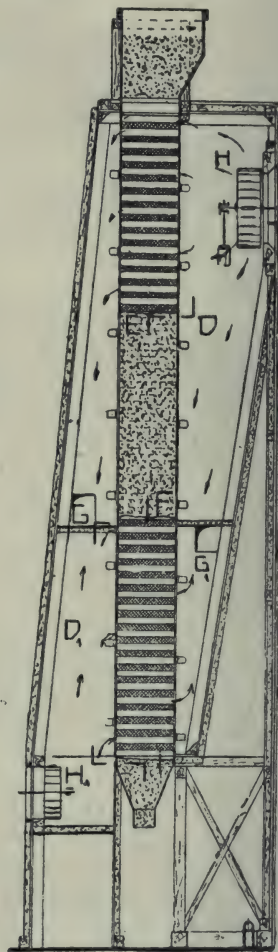


Fig. 2. — Coupe verticale montrant l'accès et la circulation de l'air.

un espace où il est séché par l'air, refoulé ou aspiré par des tuyaux. Elles sont de 2 sortes : 1) à 6 étage avec air chaud seul ; 2) à 2 étages, avec air chaud dans le haut et air frais dans le bas : toutefois l'air qui entre dans



le séchoir n'est pas refroidi à au moins  $+3^{\circ}\text{C}$ , comme il le faut pour obtenir ensuite une atmosphère ne dépassant pas  $14^{\circ}\text{C}$  et 50 % d'humidité si la céréale doit sortir du séchoir avec 12 % d'eau. La vapeur contenue dans le grain chaud a une très forte tension; capable de produire, en conditions défavorables, une violente expulsion de l'eau du grain. De là le danger que présente l'emploi des séchoirs usuels fonctionnant à des températures de l'air atteignant 60 à  $70^{\circ}\text{C}$ , et d'où le grain chaud passe ensuite sans transition à la température ordinaire du silo, beaucoup plus froid.

Voici quel doit être le principe d'un bon séchoir à grain : Une partie de l'installation fonctionnant à une température aussi haute que possible exécute la majeure partie du séchage, pendant que l'autre partie, qui lui succède, sert à refroidir peu à peu le grain chauffé. Le séchoir avec réfrigération ultérieure doit fonctionner de façon à refroidir le grain à  $14^{\circ}\text{C}$  en lui enlevant une quantité d'eau assez forte pour qu'il quitte le séchoir avec 12 % d'eau.

L'A. décrit un séchoir avec réfrigération ultérieure satisfaisant assez bien aux exigences susdites. La fig. 1 en représente une coupe verticale avec les canaux d'aération traversant la masse de grain, tandis que la fig. 2 montre de quelle façon l'air est amené et circule. La partie inférieure sert à la réfrigération : l'air à refroidir y entre en  $H_1$  et sort en  $G_1$ ; dans la partie supérieure, l'air chaud traverse le séchoir de la même manière, de  $H$  en  $G$ . Les courants d'air peuvent s'établir en sens inverse de la direction imprimée au grain. Pour ne pas surcharger les figures, on n'y a pas représenté les appareils de chauffage et de réfrigération.

Ce séchoir a un rendement de 10 tonnes à l'heure et requiert 36 000 calories par tonne si le grain est refroidi de  $40^{\circ}\text{C}$  à  $14^{\circ}\text{C}$ , en perdant 4 % d'eau. Pour fournir ces 36 000 calories, il suffit de 67 kg de vapeur d'une machine.

L'A. expose les résultats économiques d'un séchoir à postréfrigération et à marche ininterrompue, donnant un rendement de 10 tonnes à l'heure et annexé à un silo à 30 compartiments de 200 tonnes chacun. Un séchoir de ce genre parvient à traiter 200 tonnes de grain pendant 20 heures consécutives. L'installation complète de chauffage et de réfrigération requiert les capitaux d'établissement suivants :

Séchoir avec postréfrigération . . . . .	20 000 mark (1)
Installation pour la production du froid . . . . .	40 000
Machine à vapeur de 150 HP avec générateur . . . . .	70 000
<hr/>	
Coût de l'installation complète	130 000 mark
Bâtiment, etc. pour l'établissement de l'installation . .	15 000
<hr/>	
Total des capitaux d'établissement	145 000 mark
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(1) 1 mark = 1,23 fr au pair.

(N. d. R.)

Les *frais d'exploitation et d'amortissement* sont les suivants :

Combustible, eau pour la réfrigération, matériel de graissage et de nettoyage, surveillance . . . . .	6 000 mark
Intérêt et amortissement de l'installation des machines, 12,5 % pour l'année entière . . . . .	16 250
Intérêt et amortissement du bâtiment à 6,5 % pour l'année entière . . . . .	975
Imprévu . . . . .	1 775
<i>Frais totaux d'exploitation et d'amortissement</i>	<u>25 000 mark</u>

A ce montant pour la 1<sup>re</sup> opération de séchage et refroidissement de la totalité du grain viennent s'ajouter pour les mois chauds des post-réfrigérations répétées occasionnant, pour 5 refroidissements et une température initiale plus basse (de + 20° C par exemple), un surplus de frais d'exploitation de 8 000 mark en chiffres ronds. Les dépenses totales pour une année et un silo de 6 000 tonnes se montent ainsi à 33 000 mark, soit 5,5 mark par tonne de grain.

374- **État actuel du séchage des pommes de terre en Autriche.** — WIRTH, dans *Wiener Landwirtschaftliche Zeitung*, 67<sup>ème</sup> Année, N° 8, pp. 51-55 ; N° 9, pp. 59-61. Vienne, 27 et 31 Janvier 1917.

Tandis qu'en Allemagne le séchage des pommes de terre avait pris un grand développement déjà avant la guerre (1), c'est seulement au cours de celle-ci que son importance a été reconnue en Autriche. Ce pays possède actuellement près de 80 séchoirs, dont 41 ont été installés, en 1916, dans 22 établissements de séchage (sécheries) nouveaux. Au 7 décembre 1916, les sécheries affiliées au « *Kriegswirtschaftsverband der Kartoffeltrocknungsindustrie* » se répartissaient comme suit entre les diverses régions de l'Autriche :

*État des sécheries existant en Autriche au 7 décembre 1916.*

Régions	Nombre total de sécheries	Nombre de séchoirs		
		pour cossettes	pour flocons	total
Bohême . . . . .	24	18	17	35
Moravie . . . . .	12	15	8	23
Silésie . . . . .	2	2	—	2
Basse-Autriche . . . . .	3	9	2	11
Galicie . . . . .	3	—	6	6
Autres régions . . . . .	—	—	—	—
<i>Totaux</i>	44	44	33	77

(1) Voir B. 1916, n. 1216.

(N. d. R.).

*Sécheries fondées en 1916.*

Régions	Nombre total de sécheries	Nombre de séchoirs		
		pour cossottes	pour flocons	total
Bohême . . . . .	12	12	6	18
Moravie . . . . .	4	5	2	7
Silésie . . . . .	2	2	—	2
Basse-Autriche . . . . .	1	8	—	8
Galicie . . . . .	3	—	6	6
Autres régions . . . . .	—	—	—	—
<i>Totaux</i>	22	27	14	41

En outre des sécheries agricoles, ce Tableau comprend aussi les sécheries industrielles, qui mettent en œuvre 80 % des pommes de terre destinées au séchage, tandis que les sécheries agricoles n'en travaillent que 20 %.

375 — **Emploi de la fleur de soufre pour la conservation des pommes de terre** (1). — *Bulletin de la Société des Agriculteurs de France*, Tome LXXIX, pp. 10-11. Paris, Janvier 1917.

Le directeur de la Colonie agricole de Lamotte-Beuvron, France, obtient depuis longtemps d'excellents résultats en saupoudrant de soufre les pommes de terre au fur et à mesure de leur mise en silo, dans des celliers ou dans des caves.

Les pommes de terre rouges ou roses perdent un peu de leur couleur, mais conservent leur faculté germinative, tout en ne gardant aucun goût de soufre. Grâce à la chaux produite au début de la mise en tas, le soufre se transforme en anhydride sulfureux qui se répand dans tout le silo ou local et détruit les germes de pourriture à l'état latent, surtout à la surface des tubercules.

Cette méthode est également appliquée avec succès par l'Intendance, pour la conservation des stocks qu'elle accumule.

376 — **Nouveau procédé pour conserver longtemps le beurre.** — PAUL THÉODORE, dans *Chemiker-Zeitung*, 41<sup>ème</sup> Année, N° 10, pp. 74-75. Cöthen, 24 Janvier 1917.

En s'appuyant sur la documentation spéciale du sujet, l'A. a déjà montré, il y a un certain temps, la possibilité de préserver le beurre des altérations pour une longue durée en procédant ainsi : séparer la matière grasse du beurre des restes de babeurre, la conserver en récipients bien clos, puis la retransformer en beurre pour la consommation en la traitant avec du lait frais. L'A. a ensuite cherché à réaliser ce procédé de conservation, et des essais ont été entrepris dans ce sens, sous sa direction, par les D<sup>rs</sup> A. KRAUSS et MAX MÜLLER ; ils ont donné des résultats très satisfaisants et conduit à l'adoption des procédés suivants :

I. PRÉPARATION DE LA MATIÈRE GRASSE ANHYDRE. — Le beurre, contenu dans un récipient, est mis à fondre au bain-marie à 40-45° C, puis la masse fondue est abandonnée au repos. On décante ensuite la matière grasse

(1) Voir B. 1915, N° 752.

(N. d. R.)



liquéfiée dans un autre récipient chaud et sec en ayant soin de ne pas entraîner la partie aqueuse constituant la couche de fond (laquelle peut servir à des usages culinaires). D'autre part on dessèche du sel de cuisine dans une poêle, à feu nu, on le laisse refroidir un peu et on le mélange encore tiède à la matière grasse fondue, à raison de 60 g par kg de beurre. Ce mélange, remué souvent, est ensuite laissé pendant 2 à 3 heures en un lieu chaud, de façon à rester liquide, puis on le verse, à travers un entonnoir chauffé, dans des bouteilles (de couleur foncée) propres, chaudes et absolument sèches, que l'on bouche une fois pleines jusqu'à 1 à 2 cm en dessous du bord du goulot. Il n'est pas absolument nécessaire de cacheter les bouchons mais ils doivent bien fermer. Les bouteilles sont conservées en un lieu sec, froid et obscur. Par ce procédé, l'A. a obtenu de 1 kg de beurre salé en moyenne 760 g de matière grasse filtrée, assez différente du beurre fondu (« Schmelzbutter ») communément préparé en Allemagne.

## II. PROCÉDÉ POUR RETRANSFORMER LA MATIÈRE GRASSE EN BEURRE.

— D'une part on fait fondre au bain-marie, à environ 40° C, le contenu d'une bouteille de matière grasse conservée ; d'autre part on chauffe à la même température, dans une bouteille de contenance double, 15 parties en poids de lait cru frais, on y ajoute 85 parties en poids de matière grasse fondue et l'on agite constamment et vigoureusement le tout pendant 2 à 3 minutes. Ce mélange, sorte d'émulsion, est ensuite versé en mince filet dans un grand baquet contenant de l'eau mélangée de glace et constamment remuée, au contact de laquelle il doit se solidifier instantanément. Au bout d'un certain temps, on recueille cette masse solide avec une passoire, on l'égoutte et on la malaxe. Le beurre ainsi obtenu peut être consommé immédiatement, mais il gagne beaucoup en qualité si on le laisse en glacière ou en cave pendant 12 à 24 heures et si on le soumet ensuite à un nouveau malaxage. Pour préparer du beurre salé, on y ajoute jusqu'à 20 g de sel par kg.

Le produit obtenu possède la consistance, l'apparence et le goût du beurre. Il importe de verser l'émulsion en mince filet dans l'eau glacée constamment remuée pour éviter la formation de grumeaux. Avec de l'habitude, on arrive à obtenir un beurre de bonne qualité. A défaut de lait frais, on peut employer du lait stérilisé ou du lait en poudre, au détriment toutefois du goût. Par contre, l'emploi du lait condensé est exclu.

## III. CONCLUSIONS.

— En raison surtout des difficultés de répartition du beurre créées par la guerre, les 2 procédés susdits présentent les avantages que voici :

- 1) Parfaite conservation de la matière grasse du beurre fondue pendant 1 année et plus, ce qui rend le procédé très recommandable même si l'on ne se propose pas de la retransformer en beurre.

- 2) Aucune perte des constituants du beurre.

- 3) Application des procédés non seulement en grand, mais aussi dans les petites exploitations agricoles et les ménages, pour amasser et conserver en vue de la saison froide les moindres quantités de beurre fabriquées au printemps et en été.

- 4) Faculté offerte aux communes et aux fédérations communales

d'accumuler de grosses provisions de beurre pour les livrer ensuite aux consommateurs par petites quantités et sous forme commode à manier.

377 - **Conservation des poissons par le procédé de congélation d'Ottesen.** — Voir N° 354 de ce *Bulletin*.

378 - **Introduction d'une marque de garantie officielle dans le commerce du beurre produit dans l'état d'Iowa, États-Unis.** — XVI. *Iowa Yearbook of Agriculture*, pp. 368-370. Des Moines, Iowa, 1<sup>er</sup> Juillet 1916.

Dans la dernière session législative de l'état d'Iowa, la loi sur l'industrie laitière a été modifiée de manière à permettre l'introduction d'une marque officielle de garantie pour le beurre produit dans cet état. Le but de cette mesure législative, c'est d'assurer un degré d'excellence encore plus élevé au beurre de 1<sup>ère</sup> qualité produit dans l'état, d'assurer à ce produit un marché plus uniforme et un prix plus élevé sur les marchés de consommation et de réaliser la production sûre d'un type hygiéniquement supérieur tant pour la consommation locale que pour l'exportation.

Pour l'application de cette marque de garantie a été nommée une Commission exécutive composée : du président de l'Association pour l'industrie laitière de l'Iowa (Iowa State Dairy Association) ; du doyen et du professeur de fromagerie de la Faculté d'Agriculture du « Iowa State College » ; du Commissaire du Gouvernement pour les produits alimentaires (State Dairy and Food Commissioner). La Commission en question a obtenu du Gouvernement fédéral le brevet pour la marque de garantie qui indique : *Beurre de l'Iowa, de 1<sup>ère</sup> qualité*, marque brevetée du contrôle de l'État.

L'Iowa est l'état de l'Union qui produit la plus grande quantité de beurre de première qualité, mais une grande partie de ce beurre est vendue à des prix inférieurs à sa valeur réelle si l'on tient compte de sa qualité, par suite de l'absence d'un type unique auquel on puisse comparer le produit en question. La marque de garantie d'État tend à créer ce type unique.

Pour concéder la marque officielle aux fabriques de beurre, on se base sur leur contrôle périodique par la Commission, en vue de s'assurer que les règles établies pour la concession de cette marque de garantie sont scrupuleusement observées. La même marque imaginée surtout pour garantir le beurre d'exportation dans les grands centres de consommation du commerce de gros, sera employée pour les pains de beurre destinés à la consommation dans l'état d'Iowa. La Commission chargée d'appliquer la loi en question a l'appui et la coopération des principales beurreries industrielles et coopératives de l'Iowa.

## MALADIES DES PLANTES

### RENSEIGNEMENTS GÉNÉRAUX.

MESURES LÉ-  
GISLATIVES ET  
ADMINISTRATI-  
VES VISANT LA  
PROTECTION  
DES PLANTES.

- 379 - Crédits alloués en 1916-17 pour la lutte contre les maladies et les ennemis des plantes, aux Etats-Unis d'Amérique. — Voir *Bulletin* mars 1917, n° 214.

### MALADIES NON PARASITAIRES ET MALADIES D'ORIGINE INDÉTERMINÉE.

- 380 - Une nouvelle altération des pélargones, en Allemagne. — LINGELSHIM A., dans *Zeitschrift für Pflanzenkrankheiten*, 26<sup>ème</sup> année, fasc. 6-7, pp. 375-378. Stuttgart, 16 septembre 1916.

L.A. observe depuis quelques années qu'une de ses pélargones — une sorte dont la fleur est de couleur saumon et les feuilles d'un vert uniforme et privées de zones — produit des feuilles pourvues de nombreux points clairs et de fines lignes transparentes. La plante hiverne dans une cave sèche et ne produit au printemps qu'un nombre restreint de feuilles ainsi altérées. Celles-ci assimilent pendant un certain temps, puis elles jaunissent, se dessèchent et tombent. Une deuxième plante, appartenant également à une sorte sans zones et ayant des fleurs rouge-clair, montra en 1916, pour la première fois, cette altération.

En regardant par transparence la jeune feuille non encore déployée, on y observe déjà de très petits points clairs et transparents, dont le nombre augmente avec la croissance de la feuille. Ces points sont ou isolés ou réunis en groupes; quelquefois aussi ils se réunissent complètement pour former des lignes claires. Ils ont un contour circulaire ou, mais rarement, ovale. Le diamètre des points varie beaucoup, mais ne dépasse jamais  $\frac{1}{4}$  mm. Lorsque la lumière tombe verticalement sur la feuille, on s'aperçoit que les points transparents sont de petites pustules se trouvant surtout à la face inférieure de la feuille. Si, en cette partie de la feuille, plusieurs pustules se réunissent, elles présentent alors l'aspect d'une croûte mince.



Les coupes transversales du tissu altéré montrent, sous le microscope, que les pustules sont dues au développement anormal des cellules du mésophylle. Parallèlement à cette croissance on observe la disparition de la chlorophylle.

En n'examinant que superficiellement les symptômes de l'altération on est amené à croire qu'il s'agit là de la « Weisspunktkrankheit der Blätter » (maladie des points blancs des feuilles) de TUBEUF, mais les symptômes ne sont pas les mêmes. Il ne s'agit pas non plus de la « Weissfleckigkeit der Blätter » (maladie des taches blanches des feuilles) de ZACHER. SORAUER décrit la formation, sur les feuilles de *Pelargonium zonale*, de pustules blanches, analogues à celles de *Cystopus* et dans lesquelles il y a une production abondante de liège qui ne tarde pas à déchirer l'épiderme. Ce dernier phénomène n'a jamais été observé dans le cas décrit ici et les pustules n'atteignent jamais la grandeur de celles décrites par SORAUER. La maladie dite « sordago » (1), attaquant la belle de nuit (*Mirabilis Jalapa*), ne paraît non plus être identique à l'altération découverte par l'A.

## MALADIES PARASITAIRES

(BACTÉRIES, CHAMPIGNONS ET AUTRES CRYPTOGRAMES).

381 - Observations sur les maladies des plantes, effectuées en 1915 à la Station royale de Botanique cryptogamique (Laboratoire cryptogamique) à Pavie, Italie. — BRIOSI GIOVANNI, dans *Bollettino dei Ministeri per l'Agricoltura e per l'Industria, il Commercio ed il Lavoro*, série B, année XV, vol. II, fasc. 5-8, pp. 17-26. Rome, 1916.

GÉNÉRALITÉS.

En 1915, par suite de l'humidité prolongée, *Plasmopara viticola* et *Puccinia graminis*, attaquant respectivement la vigne et le blé, prirent un développement extraordinaire. Le blé a beaucoup souffert, notamment dans quelques provinces de l'Italie, aussi à cause de *Cladosporium herbarum*, *Septoria graminum* et *S. glumarum*. Le pêcher eut à subir des attaques sérieuses de *Sphaerotheca pannosa* et de *Clasterosporium carpophilum*, qui attaqua également l'amandier et l'abricotier ; le poirier et le pommier furent envahis par les *Fusicladium*. L'olivier a été gravement attaqué par *Cycloconium oleaginum* et *Stictis Panizzei* surtout dans l'Italie méridionale et dans de nombreuses régions de l'Italie centrale. La tomate et la pomme de terre subirent aussi de violentes attaques de *Phytophthora infestans*, et bien des cultures de pomme de terre furent aussi envahies par *Fusarium Solani*. Parmi les autres plantes maraîchères, les suivantes ont été le plus gravement endommagées : la fève, attaquée par *Sclerotinia Libertiana* ; le céleri, par *Septoria Apii* ; les pastèques et les melons par *Fus. niveum* et par *Colletotrichum oligochaetum* ; les haricots, par *Coll. Lindemuthianum*. De vastes plantations de rosiers, notamment sur la Côte

(1) Voir B. juin 1916, n° 686.

(N. d. R.)

ligurienne, ont été gravement attaquées par *Sphaerotheca pannosa* et *Botrytis vulgaris*.

L'A., qui dirige les travaux de la Station, persévérant dans la méthode adoptée dans ses précédents rapports, méthode qui vise à répandre parmi les agriculteurs les connaissances phytopathologiques, expose, cette fois, des renseignements succints concernant plusieurs maladies du blé dues à des parasites végétaux, tels *Micrococcus Tritici*, *Gibberella Saubinetii*, *Septoria glumarum*, *Gibellina cerealis*, *Ophiobolus graminis*, *O. herpotrichus*, *Leptosphaeria herpotrichoides*, *Sphaeroderma damnosum*, *Dilophia graminis*, *Erysiphe graminis*, *Cladosporium herbarum*, *Sclerospora macrospora*, *Septoria graminum* et *S. Tritici*.

Suit la liste détaillée des examens des matériaux d'étude, effectués par la Station en 1915, et qui se montent à 1932 en tout.

On est enfin renseigné sur les recherches scientifiques effectuées pendant la même année, et sur les publications du personnel de la Station.

382 - **Péronosporacées observées en Toscane, Italie.** — SAVELLI MARTINO, dans *Bullettino della Società botanica italiana*, n° 1, pp. 13-19. Florence, 1917.

Enumération des 24 espèces suivantes recueillies jusqu'ici dans diverses localités de la Toscane :

1) *Cystopus candidus* (Pers.) Lév. sur *Capsella Bursa-pastoris*, sur des feuilles de *Thlaspi perfoliatum*, *Barbarea vulgaris*, *Hesperis matronalis*, *Cardamine chelidonia* et *Brassica oleracea*, dans la province de Florence ; sur des feuilles de *Capparis inermis*, *Capsella Bursa-pastoris*, *Nasturtium sylvestre*, *Cakile maritima* f. *latifolia*, dans la province de Pise ; sur des tiges et des fleurs de *Capsella gracilis*, dans la province d'Arezzo ; sur *Lunaria biennis* et *Capparis spinosa*, dans la province de Sienne ; sur *Diplotaxis* sp., dans la province de Grosseto ;

2) *C. Portulacae* (D.C.) Lév., sur des feuilles et des tiges de *Portulaca oleracea*, dans les provinces de Florence et de Pise ; recueilli aussi dans celles de Sienne et de Grosseto ;

3) *C. Bliti* (Biv.) De By., sur des feuilles d'*Amaranthus patulus*, dans la province de Florence ;

4) *C. Tragopogonis* (Pers.) Schröt., sur des feuilles de *Tragopogon* sp., dans la province de Florence ; sur *Inula salicina*, dans la province de Sienne ;

5) *Phytophthora Cactorum* (Cohn et Lebert) Schröt., sur des feuilles de *Fagus sylvatica*, dans la province de Florence ;

6) *Phyt. infestans* (Mont.) De By., sur *Solanum Lycopersicum* et *S. tuberosum*, dans la province de Lucques ; sur *S. tuberosum*, dans les provinces de Florence et de Pise ;

7) *Plasmopara pygmaea* (Unger) Schröt., sur *Anemone nemorosa*, dans la province de Florence ;

8) *Pl. pusilla* (De By.) Schröt., sur *Geranium nodosum*, dans la province de Florence ;

9) *Pl. densa* (Rab.) Schröt., sur des feuilles de *Rhinanthus Crista-galli*, dans la province de Florence ;

10) *Pl. viticola* (Berk. et Curt.) Berl. et De Toni, sur la vigne, très répandu dans toutes les provinces ;

11) *Pl. nivea* (Unger) Schröt., sur *Aegopodium Podagraria*, dans les provinces de Florence et de Pise ;

12) *Pseudoperonospora cubensis* (B. et C.) Rostow, sur *Cucumis Melo*, dans la province de Florence, où il fut recueilli une seule fois, en 1906 ;

13) *Bremia Lactucae* Regel, sur *Lactuca sativa*, *Lapsana communis*, *Sonchus oleraceus* et *Senecio vulgaris*, dans la province de Pise ;

14) *Peronospora calotheca* De By. in Rab., sur des feuilles d'*Asperula odorata*, dans la province de Florence ;

15) *Per. Alsinearum* Casp., sur des feuilles de *Cerastium glomeratum*, *C. arvense* et *Stellaria media* f. *gymnocalyx*, dans la province de Florence ; sur *Stell. media* f. *trichocalyx*, dans la province de Pise ;

16) *Per. grisea* (Ung.) De By., sur *Veronica serpyllifolia*, dans la province de Florence ;

17) *Per. arborescens* (Berk.) De By., sur *Papaver dubium*, dans la province de Florence ; sur *P. somniferum*, dans la province de Pise ; sur *P. Rhoeas*, dans la province de Sienne ;

18) *Per. effusa* (Grev.) Rab., sur des feuilles de *Chenopodium murale*, dans la province de Florence ;

19) *Per. Viciae* De By., sur *Vicia sepium*, dans la province de Florence ; sur *V. sativa*, dans la province de Sienne ;

20) *Per. Ficariae* Tul., sur *Ranunculus bulbosus*, dans la province de Florence ;

21) *Per. Urticae* (Lib.) De By., sur *Urtica urens*, dans la province de Pise ;

22) *Per. alta* Fuck., sur *Plantago major*, dans la province de Florence ;

23) *Per. parasitica* (Pers.) De By., sur *Matthiola* sp., dans la province de Florence ; sur *Cheiranthus Cheiri*, dans la province de Pise ;

24) *Per. affinis* Rosm. in Rab., sur *Fumaria officinalis*, dans la province de Florence.

### 383 - Changement d'hôte des urédinées *Thecopsora sparsa* et *Pucciniastrum*

**Circaeae.** — FISCHER ED., dans *Centralblatt für Bakteriologie, Parasitenkunde und Infektionskrankheiten*, 46<sup>e</sup> vol., nos 11-16, pp. 333-334. Iéna, 2 septembre 1916.

Des essais d'infection que l'A. a exécutés au printemps 1916 avec *Thecopsora sparsa* (Wint.) P. Magn. et *Pucciniastrum Circaeae* (Schum.) Speg. ont relevé l'apparition des cecidiums encore inconnus chez ces deux urédinées.

I. — Des téléutospores de *Thecopsora sparsa*, que l'A. avait recueillies sur *Arctostaphylos alpina*, furent déposées le 3 mai 1916 sur des jeunes pousses de l'année de petites plantes en pots d'*Abies pectinata*, *Picea excelsa*, *Larix decidua* ainsi que sur quelques fleurs femelles d'un *P. excelsa* se trouvant en plein champ. Les jeunes pousses de sapins blancs utilisées pour l'essai étaient presque entièrement ouvertes, tandis que pour les épicéas l'axe n'était pas encore entièrement libéré et les aiguilles étaient en conséquence encore réunies en touffe. Le 17 mai, l'A. remarqua sur *P. excelsa*,



pour la première fois, un indice de la présence de pycnides (spermogonies) et le 19 mai, il constata des jeunes œcidiums. Une seconde série d'essais, commencée le 18 mai, vint confirmer le résultat.

En revanche, on n'a pas constaté d'œcidiums sur les cônes.

Les œcidiums rassemblent beaucoup à ceux d'autres espèces de *Thecopsora* et *Pucciniastrum* ainsi qu'à ceux de *Chrysomyxa*. Les jeunes et tendres aiguilles sur lesquelles ils font leur apparition présentent leur couleur à peine altérée. Le pseudopéridium est creux, cylindrique ou quelque peu aplati et s'ouvre le plus souvent au sommet en forme de couvercle. Les écidiospores revêtent une teinte orange.

2. — Des essais d'infection au moyen de téléutospores de *Pucciniastrum Circaeae* avaient déjà été faits antérieurement par KLEBAHN sur *A. pectinata*, *P. excelsa*, *L. decidua* et *Pinus sylvestris*, mais sans aboutir à un résultat positif. L'A. ayant pu récolter, en automne 1915, dans les environs de Berne, une abondante quantité de téléutospores, il procéda de son côté à des essais. Le 12 mai 1916, il déposa des feuilles de *Circaea lutetiana* portant des téléutospores sur des jeunes pousses de petites plantes en pots d'*A. pectinata*, *P. excelsa* et *L. europaea*. Un résultat fut obtenu sur un exemplaire d'*A. pectinata*, sur les aiguilles duquel on put relever, le 29 mai, de très nombreuses pycnides. Celles-ci se trouvent, de même que dans le cas du *Thecopsora sparsa*, sur l'épiderme et apparaissent sous forme de petites taches plates sous le cuticule. Le 2 juin, l'A. constata de jeunes œcidiums sur les mêmes pousses. Un examen ultérieur plus approfondi permit de constater des œcidiums, bien que moins nombreux, sur les autres sapins blancs à l'essai. De même que pour *Pucciniastrum Abietis-Chamaenerii*, les œcidiums ne sont pas des organes cylindriques avec pseudopéridium creux et tendre. Ils apparaissent en deux rangées à la face inférieure des aiguilles ; il est rare de les rencontrer à la face supérieure. Les écidiospores sont jaune clair tirant sur l'orange pâle.

L'A. fera suivre plus tard une description détaillée des œcidiums des deux champignons.

PLANTES  
RÉSISTANTES.

384 — **Types de tournesol résistants aux maladies et ennemis, en Russie.** — Voir n° 321 de ce Bulletin.

MOYENS  
DE LUTTE.

385 — **Bravets concernant la lutte contre les maladies et ennemis des plantes.** — Voir Bulletin mars 1917, n° 275 et Bulletin avril, n° 364.

MALADIES PA-  
RASITAIRES  
CHEZ LES DI-  
VERSES PLAN-  
TES.

386 — ***Puccinia caucasica* n. sp., parasite d'*Iris flavescens*, au Caucase.** — SAVELLI MARTINO, dans *Bullettino della Società botanica italiana*, n° 1, pp. 11-13. Florence, 1917.

L'A. décrit, comme espèce nouvelle pour la science, sous le nom de *Puccinia caucasica*, une urédinée récoltée en 1909 dans le Caucase (près de Zurnobod, province d'Elisabethzols), par le Dr SCHIELKORONINOW, sur *Iris flavescens*. Le parasite forme sur les feuilles de la plante-hôte de grandes taches, en forme de stromas, plus ou moins irrégulièrement sphériques ou ovales, bien visibles aussi bien sur la face supérieure des feuilles que sur celle inférieure.

387 - **Nouvelles observations sur la "maladie de l'encre" du châtaignier, en Italie (1). —**

PETRI L., dans *Rendiconti delle sedute della Reale Accademia dei Lincei*, Classe di Scienze fisiche, matematiche e naturali, 5<sup>ème</sup> série, 2<sup>ème</sup> semestre 1916, vol. XXV, fasc. 5, pp. 172-176, fig. 1-2 ; fasc. 12, pp. 499-501, fig. 1-2. Rome, 1916.

I. — Les conclusions auxquelles était arrivé provisoirement l'A. dans ses recherches sur l'étiologie de la « maladie de l'encre » tendaient à affirmer l'existence d'une pourriture du duramen et de l'aubier qui, du collet, allait, suivant une direction centrifuge, en même temps vers le bas de l'appareil radical et vers le haut de la tige.

Des recherches ultérieures ont permis à l'A. d'établir que l'altération du corps ligneux de la région du collet, à cours centrifuge, doit être regardée comme la conséquence immédiate de l'infection du cambium par un mycélium parasite, qui se répand rapidement dans le sens longitudinal et plus lentement dans le sens transversal. C'est ce mycélium qui détermine la nécrose contemporaine de l'écorce et de l'aubier, causant l'apparition de bandes brunes, coniques, ayant leur base vers le collet et arrivant plus ou moins haut sur la tige. On trouve aussi des bandes brunes semblables sur les grosses racines, mais, dans ce cas, elles s'élargissent vers la base des dites racines, et c'est en correspondance avec ces bandes que les « taches d'encre » paraissent à l'extérieur. Ces bandes ne sont pas en état de continuité avec celles qui sont produites par le *Coryneum perniciosum* Br. et Farn. La confluence des unes et des autres ne peut se produire que lorsque la plante est presque entièrement desséchée.

Le mycélium trouvé par l'A. est constitué par de gros hyphes non cloisonnés et qui, ayant généralement un cours longitudinal, s'insinuent parmi les parois des cellules du cambium, envoyant ça et là, mais en petit nombre, de courtes ramifications latérales. Tous les essais faits jusqu'ici pour arriver à obtenir l'isolement et la culture de ce mycélium ont été vains.

Il est certains faits qui permettent d'exclure l'identité de ce dernier avec le mycélium du *Coryneum* : 1) ses caractères morphologiques ne coïncident pas avec ceux de ce dernier ; 2) il reste localisé longtemps dans le cambium, et il n'envahit pas aussitôt l'écorce et l'aubier, ce que, par contre, le *Coryneum* fait rapidement ; 3) l'on n'en peut faire la culture suivant les méthodes ordinaires, tandis que le *Coryneum* se développe facilement dans les milieux nutritifs les plus communs ; 4) après la mort des cellules du cambium attaquées par le mycélium en question, les hyphes de ce dernier meurent également, sans que l'on ait jusqu'ici observé la formation de spores ou d'autres organes de conservation du mycélium.

Il est à présumer qu'après avoir passé sa période de vie parasitaire aux dépens du cambium, le mycélium pourvut à la formation de ses organes reproducteurs par le passage de quelques hyphes dans l'écorce, à la condition que celle-ci n'ait pas encore été envahie par des saprophytes. Cela expliquerait en même temps la diffusion relativement lente de la maladie, car les conditions favorables à la formation d'organes sporigènes ne se pro-

(1) Voir aussi B. nov. 1915, n° 1211.

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duisent pas très facilement, et la difficulté de déterminer le véritable agent pathogène auquel on doit la « maladie de l'encre ».

II. — Dans une Note successive (pp. 499-501), l'A. confirme ses précédentes observations, suivant lesquelles c'est à la présence d'un mycélium parasite dans le cambium du collet, de la base de la tige et des grosses racines des châtaigniers atteints de la « maladie de l'encre » que l'on doit attribuer l'infection primaire qui amène aux altérations maintenant bien connues caractérisant cette maladie.

Il restait, cependant, bien des lacunes à combler pour pouvoir démontrer complètement le bien-fondé de cette affirmation.

Se réservant de communiquer à mesure les résultats précis des recherches entreprises à cet effet, l'A. s'arrête, en attendant, sur l'un des points non encore éclaircis, celui qui regarde le lieu de l'infection originaire et la manière dont elle se présente. Or, les recherches exécutées pendant l'automne de 1916 ont démontré que l'infection originaire se produit dans la région de la base des grosses racines, et que le mycélium pénètre dans le parenchyme cortical de celles-ci à travers la fine couche péridermique qui protège l'écorce vivante au fond des fissures du rhytidome.

En pratiquant une coupe tangentielle sur une racine attaquée depuis peu de temps, et précisément à la hauteur d'une petite « tache d'encre », il ressort nettement sur le parenchyme cortical sain, qui est blanc jaunâtre, une tache fuligineuse entourée d'une ligne brune. Cette tache s'approfondit plus ou moins dans le parenchyme, et suivant la date plus ou moins récente de l'infection, l'altération finit par atteindre le cambium. Le long de ce tissu, et principalement dans le sens de la longueur, le mycélium croît avec rapidité, se répandant de préférence vers le collet et de celui-ci vers la base du tronc au niveau du sol.

L'un des faits qui peut le plus facilement induire en erreur dans ces recherches, c'est l'existence de deux catégories de « taches d'encre » sur les racines. Celles qui viennent d'être décrites, que l'A. appelle « primaires », se manifestent sur les racines saines, ayant leur aubier et leur duramen complètement à l'état normal, et elles sont dues à l'infection directe du mycélium parasite, qui, déterminant la nécrose de nombre de cellules de l'écorce, provoque aussi l'oxydation des matières tanniques y contenues.

La seconde catégorie de « taches d'encre », et que l'A. appelle « secondaires », est constituée par le brunissement ne différant en rien, chimiquement, de celui des taches « primaires » ; et il est produit par l'altération de l'écorce, déterminée, par voie secondaire, comme conséquence de la mort du cambium, dépendant d'un processus de pourriture qui s'étend du duramen à l'aubier.

Cette altération, à cours centrifuge, se produit souvent dans les grosses racines des châtaigniers dont le collet est déjà attaqué par le parasite spécifique. Il s'agit là d'un processus de pourriture dû à diverses espèces de champignons, variant d'une localité à l'autre, et parfois, d'une plante à l'autre.

La nécrose de certaines portions de l'écorce est accélérée par l'inter-



vention de mycéliums saprophytes qui favorisent l'oxydation rapide des matières tanniques.

Cette oxydation, à laquelle on doit le brunissement, se produit même en l'absence de microorganismes, par la seule action de l'oxygène de l'air, mais il existe vraiment des espèces de champignons qui provoquent même *in vitro* le brunissement des tannins de l'écorce du châtaignier.

Les taches d'infection récentes de l'écorce ne s'élargissent pas ultérieurement quand on place les parties de racines dans un milieu humide ou sous le sable.

Le mycélium parasite meurt rapidement, dès que les tissus qu'il attaque se trouvent dans des conditions où leur activité vitale décroît très vite. Le fait est en relation avec le résultat négatif des essais faits pour isoler le mycélium, qui se comporte donc comme un parasite obligé.

La recherche soigneuse des causes qui en déterminent la mort dans le cas exposé ci-dessus, a démontré qu'il s'agit toujours de l'effet d'actions antagonistes exercées par d'autres microorganismes qui se développent dans le tissu déjà désorganisé par le mycélium parasite.

## PHANÉROGAMES PARASITES ET MAUVAISES HERBES.

388 - *Sida acuta*, plante infestante dans le Queensland, Australie (1). — BAILEY J. F. et WHITE C. T., dans *Queensland Agricultural Journal*, vol. VI, 4<sup>ème</sup> partie, p. 262, pl. 34. Brisbane, 1916.

Il est un peu difficile d'établir si la malvacée *Sida acuta* Burm. est indigène du Queensland ou si elle y a été introduite. C'est une mauvaise herbe très répandue dans les pays tropicaux, et, étant donné sa grande ressemblance avec *S. rhombifolia* L. — plus communément connue sous le nom de *S. retusa* L. — elle a pu échapper aux botanistes du Queensland.

Durant ces dernières années, des exemplaires n'ont été récoltés que dans certaines localités septentrionales. M. E. JARVIS de Gordonvale, près de Cairns, affirme que cette malvacée est un grave fléau et qu'elle est la plus commune des espèces de *Sida* existant dans cette région.

Lors d'une récente visite à Townsville, les AA. se sont rendu compte que *S. acuta* et *S. cordifolia* L. étaient deux des plus communes mauvaises herbes de ce district et que *S. acuta* était beaucoup plus fréquente que *S. rhombifolia*.

Quoi qu'elle ne soit qu'une mauvaise herbe, *S. acuta* peut avoir quelques usages économiques. Les indigènes de l'île de Guam utilisent les tiges de cette plante et d'espèces voisines pour confectionner des balais. Aux Philippines et dans l'Inde on a recours aux feuilles et aux racines en raison de leurs propriétés thérapeutiques.

En ce qui concerne la lutte contre cette mauvaise herbe, ce qui est le plus efficace dans les petites cultures, c'est d'arracher les plantes à la main

(1) Voir aussi *B.* févr. 1917, n° 204.

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ou de les couper au-dessous de la surface du sol ; dans les grandes surfaces où cette malvacée montre une puissante végétation, on conseille les pulvérisations avec une des préparations propres à combattre les mauvaises herbes. La lutte doit être effectuée avant la formation des graines.

389 - *Sonchus oleraceus* et *Hypochoeris radicata*, plantes infestantes de la Nouvelle-Galles du Sud, Australie (1). — MAIDEN J. H., dans *The Agricultural Gazette of New South Wales*, vol. XXVIII, 1<sup>ère</sup> partie, pp. 46-48, 2 pl. en couleur. Sydney, 1917.

Description des deux composées *Sonchus oleraceus* L. (« row thistle ») et *Hypochoeris radicata* L. (« cat's ear », « flat-weed »).

La première de ces deux plantes est considérée par l'A. comme ayant été introduite en Australie. L'unique moyen de combattre cette mauvaise herbe, douée d'un grand pouvoir de diffusion, est de l'extirper avant la maturité des akènes.

Contre *H. radicata*, répandu à présent dans tous les Etats australiens, on doit avoir recours à la pioche ou à un autre instrument tranchant si une telle opération n'occasionne pas une grande dépense.

On peut avoir avantage aussi à faucher les inflorescences, mais, comme dans le cas de *S. oleraceus*, il s'agit ici d'une mauvaise herbe qui se reproduit et se répand avec une grande rapidité.

390 - Moyens de lutte contre *Cirsium arvense* (= *Cnicus arvensis*). — Voir n° 313 de ce Bulletin.

## INSECTES ET AUTRES INVERTÉBRÉS NUISIBLES.

### GÉNÉRALITÉS.

391 - Chalcidides des figuiers sauvages, observés dans l'Inde et dans les îles de Ceylan et de Java. — GRANDI G., dans *Bollettino del Laboratorio di Zoologia generale e agraria della R. Scuola superiore d'Agricoltura in Portici*, vol. XI, pp. 183-234, fig. I-XX, et vol. XII, pp. 3-60, fig. I-XXII. Portici, 1917.

Description systématique des hyménoptères suivants :

a) de l'Inde : 1) *Ceratosolen gravelyi* Grandi, vivant dans les sycones de *Ficus Cumia* ; 2) *Eupristina saundersi* n. sp., dans les sycones de *F. religiosa* et de *F. retusa* var. *nitida* ;

b) de Ceylan : 1) *Blastophaga gestroi* Grandi : figuier-hôte inconnu ; 2) *Ceratosolen fuscipes* Mayr, dans les sycones de *F. glomerata* ; 3) *Eupristina grassii* n. sp. : figuier-hôte inconnu ; 4) *Sycophaga brevitarsus* Grandi : figuier-hôte inconnu ; 5) *Apocrypta westwoodi* Grandi, dans les sycones de *F. glomerata* ;

c) de Java : 1) *Blastophaga ? puncticeps* Mayr, dans les sycones de *F. fulva* ; 2) *B. puncticeps distinguenda* Grandi : figuier-hôte inconnu ; 3) *B. boldinghi* Grandi, dans les sycones de *F. lanata* ; 4) *B. valentinae* Grandi, dans les sycones de *F. cuspidata* ; 5) *B. jacobsoni* Grandi, dans les sycones de *F. procera* var. *crassiramea* ; 6) *Ceratosolen striatus* Mayr, dans les sycones de *F. variegata* ; 7) *C. striatus notandus* Grandi, dans les sycones de

(1) Voir aussi *B. oct.* 1916, n° 1136.

(N. d. R.)

*F. variegata* ; 8) *C. crassitarsus* Mayr, dans les sycones de *F. Ribes* ; 9) *Eupristina emeryi* Grandi : figuier-hôte inconnu ; 10) *E. koningsbergeri* Grandi, dans les sycones de *F. Benjamina* var. *comosa* ; 11) *Sycophaga spinitarsus* Mayr, dans les sycones de *F. variegata* ; 12) *S. tristis* Grandi, dans les sycones de *F. glomerata*.

392 - **Nouvelles espèces d'hyménoptères chalcidides parasites de cochenilles, dans la Côte de l'Or et dans la Nigéria méridionale, Afrique.** — WATERSTON JAMES, dans *Bulletin of Entomological Research*, vol. 7, 3<sup>e</sup> partie, p. 231-257, fig. 1-9. Londres, 1917.

Description systématique de :

- 1) *Aneristus croconotus*, n. sp., obtenu de *Lecanium* sp. vivant sur oranger et *Tephrosia Vogellii*, à Aburi (Côte de l'Or) ;
- 2) *Coccidoxenus coelops* n. sp., élevé de *Ceroplastes ouilleli* Marchal, Nigéria méridionale ;
- 3) *Cocc. obscuratus* n. sp., élevé de *Lecanium somereni* Newst., à Aburi ;
- 4) *Chiloneurus afer* n. sp., obtenu de *Pulvinaria jacksoni* Newst., à Aburi ;
- 5) *Chil. cyanotus* n. sp., de *Lecanium* sp. vivant sur *Tephrosia Vogellii*, à Aburi ;
- 6) *Cerapterocerus* (*Eusemion*) *pattersoni* n. sp., de *Vinsonia personata* Newst., à Aburi ;
- 7) *Eunotus truncatipennis* n. sp., de *Lecanium* (?) *somereni* Newst. vivant sur kolatier, à Aburi.

393 - ***Wolffiella ruforum* n. gen. et n. sp., chalcidide parasite des œufs de *Lophyrus rufus*, en Allemagne.** — KRAUSSE ANTON, dans *Zeitschrift für Forst- und Jagdwesen*, 49<sup>ème</sup> année, fasc. 1, pp. 26-35. Berlin, janvier 1917.

Lors d'une excursion faite en vue d'étudier les dégâts occasionnés par *Lophyrus pini* en 1915, le prof. MAX WOLFF a recueilli une grande quantité de branches de pins aux aiguilles desquels étaient attachés des œufs de *L. rufus*. Les branches furent mises par l'A. en partie dans de grands verres d'élevage, en partie dans une boîte de Petri et en partie dans une caisse en bois. Durant l'hiver les verres et la boîte furent conservés dans un laboratoire chaud, la caisse se trouvait dans un local non chauffé à proximité d'une fenêtre. Il est à remarquer à cet égard que les œufs hivernent de cette manière facilement.

Au 5 mars 1916 l'A. a vu éclore le premier chalcidide dans la boîte, le jour suivant deux autres chalcidides ont apparu dans les verres d'élevage, et le 7 mars apparaissaient des chalcidides même dans la caisse. La différence de la température n'avait donc nullement influencée l'éclosion de l'insecte, ce qui est un fait remarquable. On a observé dans la suite jusqu'au 5 avril l'apparition de nouveaux chalcidides. Tous les insectes observés jusqu'ici par l'A. étaient de sexe féminin.

Comme les aiguilles de pins ne contenaient pas d'autres œufs, il est hors de doute que le chalcidide étudié provient des œufs de *L. rufus*.

L'A. a compté les trous par lesquels le chalcidide avait quitté l'œuf de 10 aiguilles choisies librement, et il en a constaté 44.

MOYENS  
DE LUTTE.



Ce chalcidide, très petit, constitue, d'après l'A., un nouveau genre qu'il appelle *Wolffiella ruforum*.

394 - De la solubilité du bouclier du "kermès virgule" ou "kermès coquille" (*Lepidosaphes ulmi*). — MAULIK S., dans *Bulletin of Entomological Research*, vol. VII, 3<sup>ème</sup> partie, pp. 267-269, fig. 1. Londres, 1917.

On y trouve rapportés les résultats des recherches faites sur la solubilité du bouclier qui protège la cochenille *Lepidosaphes ulmi* Linn. (syn. de *Mytilaspis pomorum* Bché.), si nuisible à divers arbres cultivés, particulièrement au pommier. La lutte contre ce parasite, par le moyen d'insecticides, dépend en grande partie de la possibilité que ces matières parviennent jusqu'à l'insecte, moyennant la dissolution du bouclier duquel la cochenille se recouvre aussitôt après s'être fixée sur l'écorce de la plante-hôte. Quel que soit le développement de l'insecte, tant que le bouclier en question n'est pas dissous, au moins à son point de contact avec l'écorce, il ne faut pas s'attendre à de grands résultats de l'application des insecticides.

On croit généralement que ce bouclier est de nature cireuse. Aussi l'A. a-t-il fait usage de divers réactifs (éther de pétrole, benzène, alcool, xylol, chloroforme, acétone, toluène, alcool méthylique, sulfure de carbone, éther méthyle, tétrachlorure de carbone, pétrole, terpinol, essence de girofle, acétate d'éthyle, pyridine, et solution de savon), et cela dans le but de trouver autant que possible un dissolvant convenable.

Pour les expériences y relatives, les boucliers de *L. ulmi*, obtenus en un état de pureté suffisante, grâce à un traitement opportun, puis placés dans des tubes d'essai, ont été soumis à l'action des réactifs indiqués plus haut, pendant environ un an, mais il ne semble pas qu'il s'y soit manifesté une modification quelconque. En tout cas, les boucliers n'ont pas été dissous.

Quant aux propriétés du bouclier, l'A. a constaté qu'il n'est pas dissous par l'acide sulfurique concentré, ni par le carbonate de soude même chaud ; qu'il est hygroscopique et qu'il perd de 8 à 9 % de son poids, si on le chauffe au bain-marie ; qu'il contient environ 4,5 % d'azote ; qu'il se dissout dans une solution normale de soude ou potasse caustique. Bien que l'alcalin caustique dissolve le bouclier dans le tube d'essai, son application comme liquide à pulvérisation n'en est pas du tout heureuse, ainsi que l'A. l'a constaté au cours d'expériences pratiquées dans un verger. Il a employé la solution de potasse caustique, à des degrés de concentration variés, sans arriver jamais entièrement à prévenir l'éclosion des insectes. En outre, l'application de l'alcalin caustique se heurte à des difficultés mécaniques, et il n'est pas sans inconvénients pour l'opérateur.

Dans la composition des liquides à pulvérisation, actuellement en usage, il entre de la soude caustique, de la chaux, de la paraffine, du sulfate de fer et du sulfate de cuivre. Les boucliers ayant été traités dans le tube d'essai avec ces réactifs, pris séparément et dans leurs combinaisons formant les liquides insecticides en usage, on a trouvé qu'ils n'exercent aucune action dissolvante, sauf la soude caustique. On rappelle toutefois que ces liquides ont été reconnus efficaces jusqu'à un certain point. Cela peut être attribué à l'action purement physique de la paraffine à cause de sa basse tension

superficielle. Cette propriété permet à l'huile de pénétrer dans les moindres fissures et de bien humecter la superficie. Les insectes qui éclosent et se trouvent en contact avec l'huile sont tués. La paraffine peut aussi parvenir jusqu'aux œufs, en pénétrant sous le bouclier aux points où le contact avec l'écorce de la plante-hôte en est réduit par les conditions atmosphériques. Si, par ce moyen, les œufs existant sous le bouchier se trouvent complètement imbibés d'huile, il est très improbable qu'ils arrivent à éclore. D'autre part, puisque il y a de très rares probabilités que l'huile parvienne à exercer cette action sur la masse entière des œufs, il arrive que, même après une bonne pulvérisation, un fort pourcentage d'insectes arrive à éclosion.

On admet généralement que les insecticides qui agissent par contact tuent les insectes en en attaquant gravement le système respiratoire. Or, chez *L. ulmi*, les stigmates, c'est-à-dire les orifices à travers lesquels les insecticides peuvent agir, sont au nombre de deux paires et situés sur la partie ventrale de la cochenille, par conséquent plus ou moins protégés par le corps même de l'insecte, ce qui réduit les probabilités que les insecticides puissent les atteindre.

Puisque l'insecte envahit principalement le tronc, et, par voie secondaire, la base des branches les plus grosses, l'A. conseille comme le meilleur remède, avant tout de frotter soigneusement ces parties de l'arbre avec une brosse dure trempée dans de l'eau chaude, pendant l'hiver, alors que les œufs sont à l'état de repos, et de pulvériser avec une faible solution d'émulsion de paraffine, le printemps suivant, les arbres sur lesquels paraissent des insectes nouvellement éclos, provenant d'œufs inévitablement échappés à l'action du premier traitement.

395 - *Tomaspis tristis*, rhynchote nuisible à la canne à sucre, dans le Surinam, Amérique du Sud (1). — WILLIAMS C. B., dans *Bulletin of Entomological Research*, vol. 7, 3<sup>ème</sup> partie, pp. 271-272. Londres, 1917.

Le 19 juin 1916, l'A. a visité la ferme de Marienburg, où précédemment on avait signalé, comme nuisible à la canne à sucre, le rhynchote *Tomaspis tristis* F. (fam. *Cercopidae*). En deux endroits de l'exploitation, gravement atteints l'année précédente, il trouva effectivement cet insecte, mais non en quantité suffisante pour causer des dommages. Mais, comme la saison humide était à peine commencée, il n'était pas improbable qu'il y eût une rapide augmentation des individus des individus du rhynchote au cours des mois suivants.

Les adultes, beaucoup plus grands que ceux de l'espèce existant dans l'île de la Trinité (*T. saccharina* Dist.), se trouvaient dans leur position caractéristique, la tête tournée en l'air, à la base des feuilles de la canne.

Au moment où l'A. les recueillit (midi), ils étaient en un état de torpeur, et ils se laissaient prendre avec les doigts. On a capturé 11 femelles et seulement 4 mâles.

On n'a pas trouvé d'œufs dans le champ, mais on en a obtenu quelques-

INSECTES ET  
AUTRES INVER-  
TÉBRÉS NUISI-  
BLES CHEZ LES  
DIVERSES PLAN-  
TES.

(1) Voir aussi B. juin 1914, n. 589.

(N. d. R.)



uns de femelles en captivité, auxquelles on donna des feuilles vertes et des résidus végétaux morts et humides. Les œufs, sans exception, ont été déposés sur ces derniers à une certaine profondeur, et même, dans certains cas, à une profondeur supérieure à celle à laquelle *T. saccharina* a coutume de les déposer. Nombre d'œufs furent aussi déposés sur une feuille morte qui s'était enroulée. Sept femelles, dont une à peine parue et qui probablement n'avait pas encore pondue, donnèrent plus de 60 œufs en vingt-quatre heures.

Les jeunes insectes, entourés de leur écume, ont été ordinairement trouvés sous les gaines foliaires de la canne presque au niveau du terrain ou à une petite profondeur. Un individu fut observé dans des feuilles enroulées au sommet de la plante. L'A. n'a pas eu l'occasion d'examiner les racines, mais il a été assuré que l'on n'a jamais vu de jeunes individus du rhynchote sur ces organes. Cela constitue une différence importante dans les mœurs de *T. tristis* relativement à celles de *T. saccharina* et de l'espèce trouvée à Demerara (*T. flavilatera* Urich).

L'écume émise par *T. tristis* est semblable à celle de *T. saccharina*, mais différente de celle de *T. pubescens* F., dont l'A. a recueilli un exemplaire sur l'herbe poussant le long d'un côté d'un champ de canne à sucre.

On a recueilli, en tout, 71 jeunes individus du rhynchote, à divers stades de leur développement.

L'A. n'a pas constaté sur le champ la présence d'ennemis naturels de cet insecte.

L'insecte en question semble pouvoir être un ennemi sérieux de la canne à sucre, mais étant donné son habitude d'attaquer cette plante au-dessus du sol, il ne pourra jamais, d'après l'A., devenir aussi dangereux que *T. saccharina*, car le chaume résiste à la soustraction de la sève, mieux que les racines. D'autre part, l'inondation des champs, comme on la pratique à Demerara pour *T. flavilatera*, aurait peu d'effet ou même aucun sur *T. tristis*.

A en juger par le nombre d'insectes que l'A. a pu recueillir en très peu de temps, il est à retenir que le ramassage à la main puisse être efficace, surtout au début de la saison humide, si le rhynchote reparait en aussi grande quantité qu'en 1915. La position des jeunes individus sur le sol se prête bien naturellement à la lutte moyennant des pulvérisations, si cette pratique était considérée comme possible. On pourrait aussi faire un essai réduit des pièges lumineux.

L'A. n'a pas trouvé trace du champignon *Metarrhizium Anisopliae* sur les insectes existant dans le champ de canne. Si cet ennemi naturel pouvait y être introduit, l'action en serait peut-être très efficace, étant donné les conditions climatiques favorables de la région.

Au Musée de Georgetown, on conserve des exemplaires de cette espèce, indiqués comme recueillis à la Guyane anglaise, mais cette rencontre mérite d'être confirmée. L'espèce la plus voisine qui ait été signalée à la Trinité, c'est *T. guppyi* Urich, insecte apparemment rare et dont on ignore les mœurs.



## VERTÉBRÉS NUISIBLES.

396 - **Pour la lutte contre les campagnols en Italie.** — SPLENDRE ALFONSO, dans *Rendiconti delle sedute della Reale Accademia dei Lincei*, Classe di Scienze fisiche, matematiche e naturali, 5<sup>ème</sup> série, 2<sup>ème</sup> semestre 1916, vol. XXV, fasc. 6, pp. 218-224, et fasc. 12, pp. 516-521. Rome, 1916.

I. — La mortalité spontanée de ces rongeurs, observée par l'A. d'abord dans la région de « Contessa » près de Cerignola (1), suivant ce qui ressort d'une seconde note (pp. 218-224), s'est développée et répandue dans diverses localités. Elle a été reconnue non seulement dans d'autres régions de Cerignola, mais aussi dans plusieurs localités d'autres pays, dans la province de Foggia, dans celle de Bari, et aussi dans celle de Potenza. Cela s'est produit aussi dans les zones où l'on n'a jamais employé aucun poison contre ces animaux.

Il s'est aussi manifesté une mortalité spontanée notable chez des campagnols envoyés au Laboratoire d'Entomologie agricole de l'Université royale de Rome et provenant de localités de la Capitanate (province de Foggia) très envahies par ces rongeurs, mais situées très loin de la région de « Contessa ».

L'A. croit que la dissémination des campagnols, effectuée de la région de « Contessa » dans diverses autres localités, a influé considérablement sur cette propagation de l'épizootie.

En ce qui concerne l'infection que détermine l'épizootie, elle présente les caractères d'une septicémie. Les lésions anatomiques que présentent les campagnols morts consistent en une congestion des organes internes, qui sont alors devenus, surtout la rate et le foie, d'un volume plus fort et d'une couleur rouge-brun.

La *causa mortis* est, comme l'A. l'a déjà fait remarquer précédemment, une bactérie. Il l'a trouvée, non seulement chez tous les campagnols frappés par cette épizootie spontanée, et que l'on a examinés en très grand nombre, mais aussi chez tous ceux qui moururent à la suite d'une infection produite expérimentalement par le moyen d'une matière pathologique directe ou d'une culture y relative.

Les formes les plus réduites de ce microorganisme ne dépassent pas le diamètre de  $0,5\ \mu$ ; les plus grandes atteignent et dépassent même  $2\ \mu$  de longueur et  $0,5\ \mu$  de largeur. Cette bactérie est en outre pourvue d'une capsule. On la cultive facilement dans les milieux artificiels ordinaires, non seulement à la température du thermostat ordinaire (30-37), mais aussi à la température ambiante du laboratoire. Après avoir exposé quels sont les caractères que le microorganisme prend dans les divers milieux de culture, l'A. fait remarquer que, dans les cultures, la bactérie apparaît comme immobile ou douée de mouvements très lents, et que le germe provenant de la culture perd sa résistance au Gram.

(1) Voir B. sept. 1916, n° 1056.

L'A. pense que la bactérie étudiée par lui représente une espèce nouvelle qu'il distingue, au moins provisoirement, sous le nom de *Bacterium Pytymysi*, afin de rappeler qu'elle est la cause de l'épizootie de *Pytymys savii*.

Les recherches de laboratoire sur la transmission expérimentale exécutées, non seulement sur des individus de *P. savii*, mais encore sur *Mus sylvaticus*, *M. decumanus* et sur un petit lapin, ont permis d'établir que l'épizootie des campagnols étudiée par l'A. est due au *Bact. Pytymysi* et que le « virus » y relatif est contagieux pour *P. savii* comme il est d'ailleurs aussi pathogène pour d'autres animaux.

En outre, l'A. a isolé la même bactérie de l'intestin de quelques puces recueillies sur le corps de *Pytymys* atteints de l'infection. Le contenu de l'intestin de trois de ces insectes ayant été inoculé à un *Pytymys* sain, celui-ci mourut en moins de 24 heures. Un autre *Pytymys*, en apparence sain et bien nourri, a été placé dans un bocal où on lâcha trois puces vivantes, le rongeur est mort trois jours après. Dans le premier cas comme dans le second, l'autopsie a mis en évidence les lésions anatomiques ordinaires, et l'examen microscopique a permis de constater, dans les tissus des divers organes internes, la présence de cette bactérie.

Ces observations confirment, d'après l'A., le soupçon déjà exprimé par lui à cet égard, que la propagation naturelle de l'infection en question, chez les campagnols, est due à des ectoparasites tels que les puces.

Cela dit, et sans abandonner, par prudence, l'usage des poisons et des autres moyens de destruction, il pense toujours de plus en plus justifiée la méthode déjà indiquée par lui, et consistant à disséminer des campagnols atteints de cette infection, dans les régions envahies par ces rongeurs, où aucune épizootie ne se serait encore développée, et, pour être plus sûr au sujet du succès de l'infection, cela vaudra la peine d'infecter, par inoculation de matière provenant d'organes de campagnols infectés, le plus grand nombre possible de ces animaux, pour en faire la distribution aux agriculteurs des diverses régions.

II. — Dans une troisième Note (pp. 516-521), l'A. rend compte des larges expériences entreprises en pleine campagne dans le but de propager l'épizootie des campagnols. Le résultat des essais effectués, à cet effet, dans les terrains de l'Ecole d'Agriculture de Cerignola et dans une pépinière de vignes américaines, dans la région appelée « Pozzo delle Capre », près de S. Severo, correspondant parfaitement à celui que l'on a obtenu dans des recherches de laboratoire, a encouragé davantage à une application toujours plus large de la méthode de lutte indiquée par l'A. En conséquence, avec le « virus » de cette épizootie, plusieurs fois, tant au Laboratoire d'Entomologie agricole de Rome, qu'à l'Ecole d'Agriculture de Cerignola ou au siège du Consortium agricole de S. Severo, on a procédé à l'inoculation de nombreux campagnols, qui, ainsi infectés, ont été ensuite disséminés dans les campagnes envahies de diverses localités infestées. Au bout de quelque temps, il en est résulté que là, où l'on avait disséminé des campagnols inoculés, ces rongeurs, sur des zones très vastes, avaient complètement disparu ou bien le nombre en avait tout au moins diminué no-

tablement. De plus, si l'on arrivait à capturer des campagnols vivants et qu'on les transportât au Laboratoire, ils mouraient en peu de temps, et, à l'autopsie, on trouvait chez eux les altérations anatomiques et les éléments microbiologiques de l'infection propagée. Le microorganisme pathogène y relatif, présentait à nouveau, à l'examen de la culture, les caractères du *Bact. Pytymysi* déjà notés.

Par des essais de culture, l'A. a encore une fois retrouvé cette bactérie dans l'intestin des puces recueillies sur les campagnols infectés de cette nouvelle série d'observations. Les puces rencontrées sur *P. savii* semblaient appartenir aux genres *Ceratophyllus* Curt., *Ctenopsylla* Kol. et *Hystriophsylla* Tasch.

Outre l'épizootie rappelée plus haut, il y a eu plus récemment encore, dans la Capitanate, d'autres foyers de mortalité des campagnols, dus à des germes infectieux, dont les caractères ne répondent pas complètement à ceux du microorganisme décrit plus haut.

En effet, en examinant, au début d'octobre 1916, des individus de *P. savii* morts à l'Ecole d'Agriculture de Cerignola, après avoir été capturés vivants dans diverses localités de la province de Foggia, l'A. a constaté que, tandis que certains de ces rongeurs présentaient des caractères anatomiques et bactériologiques tout à fait identiques à ceux des cas de la région de « Contessa », d'autres de ces campagnols morts pouvaient se distinguer à une tumeur de la rate, beaucoup plus volumineuse et moins brune que chez les premiers. En outre, dans les organes internes des seconds, au lieu de la bactérie courte et trapue des premiers, on rencontrait en grande abondance un microorganisme ayant l'aspect de bâtonnets minces et déliés.

Ce dernier microorganisme présente, dans les tissus, de 1 à 5  $\mu$  de longueur et environ 0,30  $\mu$  de largeur. La coloration en est facile suivant les méthodes communes, mais il est moins résistant au Gram que la bactérie précédente. Dans les cultures, développement à la température ambiante du laboratoire, mais mieux encore à celle du thermostat ordinaire (30-37) ; morphologie et dimensions semblables à celles que le microorganisme présentait dans les tissus ; aucune résistance au Gram ; mouvements actifs assez vifs.

Ayant exposé quelle est la manière de se comporter de cette bactérie dans les divers milieux artificiels, l'A. relève, quant au pouvoir pathogène dans des expériences de transmission, que cette bactérie, autant que la précédente, s'est montrée active. Elle tuait, en peu de temps, parfois même en moins de 24 heures, quelques individus de *P. savii*, *M. sylvaticus* et *M. musculus*. Naturellement, l'infection, en présence de cette seconde bactérie, a toujours été vérifiée moyennant les examens microscopiques et de cultures requis. Par des inoculations sous-cutanées, l'A. a pu reproduire l'infection toutes les fois qu'il l'a expérimentée.

Il est un fait intéressant, c'est d'avoir retrouvé un microorganisme, que l'A. considère comme identique à ce second germe pathogène de *P. savii*, chez un individu de *M. sylvaticus*, spontanément infecté, et qui, parvenu à l'A. des fermes de Pavoncelli de Cerignola, mourait quelques



heures après son arrivée au Laboratoire de l'École d'Agriculture de Cernigola.

Enfin, au commencement de novembre 1916, arrivaient au Laboratoire d'Entomologie agricole de Rome environ 200 campagnols capturés sur le territoire de Torremaggiore, en une localité où, depuis longtemps, s'était manifestée une mortalité de ces rongeurs, et où, à ce qu'on sait, au moins jusqu'à cette date, l'on n'avait fait l'application d'aucun « virus ». Arrivés au Laboratoire, ces campagnols commencèrent à mourir, et peu à peu, ils moururent tous deux ou trois jours après leur arrivée.

A l'autopsie, on trouvait chez la plupart une congestion des organes internes et une tumeur de la rate, plus ou moins comme dans les cas d'infection enregistrés plus haut, et, à l'examen microscopique, on trouvait dans les tissus affectés une petite bactérie morphologiquement semblable à celle de la dernière infection rappelée. Dans les recherches portant sur les cultures, ce microorganisme avait une manière de se comporter différente de celle des bactéries précédemment décrites. Dans les tissus, il présentait la forme de bâtonnets fins et déliés, de 2 à 3  $\mu$  de longueur, de 0,20 à 0,30  $\mu$  de largeur, ne résistant pas au Gram. Dans les cultures, développement en général peu fort lorsqu'on se servait des milieux ordinaires ; morphologie et manière de se comporter aux colorations comme dans les tissus ; mouvements actifs, mais pas très vifs.

Après avoir dit la manière de se comporter de cette bactérie, dans les divers milieux de culture, l'A. ajoute que ce microorganisme, comme les précédents, s'est, dans les expériences, montré pathogène pour *P. savii* et *M. sylvaticus*.

Il y a donc trois espèces de germes pathogènes que l'A. a rencontré jusqu'ici chez les campagnols dans la Capitanate. Il pense que ce sont des espèces de bactéries non encore décrites, et, pour les indiquer, conservant, au moins encore à titre provisoire, pour eux le nom de *Bact. Pytymysi* qu'il leur applique en commun, suivant l'ordre dans lequel ils ont été décrits, il spécifie chacune d'elles par les chiffres I, II, III.

L'A. pense que, si on les applique avec opportunité, ces trois bactéries pourront être fort utiles dans la lutte à livrer aux campagnols.

397 - *L'ondatra* musqué (*Fiber zibethicus*), nuisible aux osiers en Bavière et en Bohême. — Voir n° 355 de ce Bulletin.

INTERNATIONAL INSTITUTE OF AGRICULTURE  
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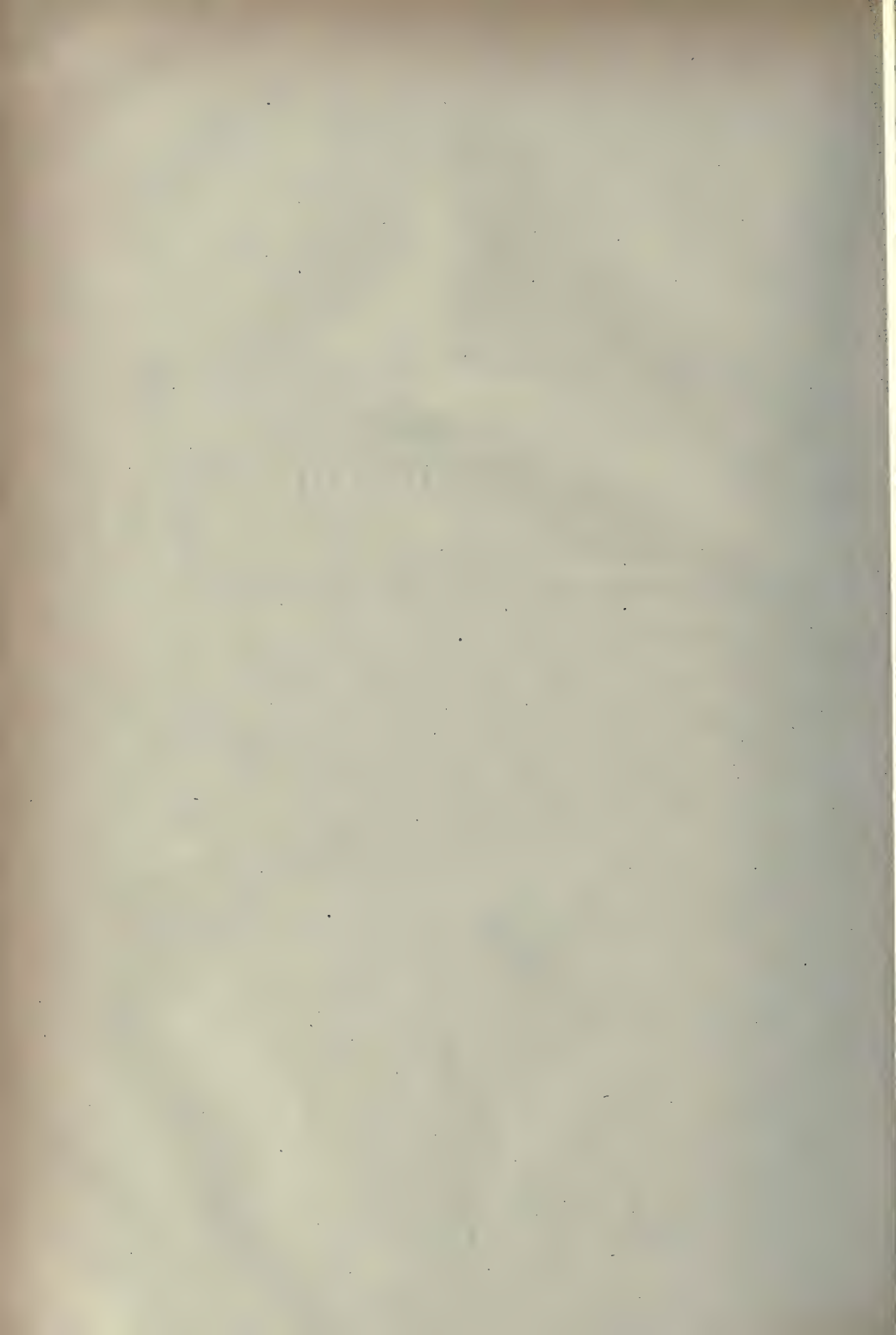
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FIRST PART  
ORIGINAL ARTICLES

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**The Recent Work at Rothamsted  
on the Partial Sterilisation of Soil.**

E. J. RUSSELL, D. Sc.

*Director of the Rothamsted Experiment Station.*

The investigations which I propose to describe began in the first instance as the result of an accident. In virtue of its large population, soil absorbs a considerable quantity of oxygen and evolves a corresponding amount of carbon dioxide. An experiment had been arranged to demonstrate the well-known fact that soil heated to 130° C., and therefore completely devoid of micro-organisms, lost much of its power of absorbing oxygen. By an accident, the autoclave was not available and the soil was only heated in a steam oven, and it gave the remarkable result that its power of absorbing oxygen, instead of falling, as was anticipated, considerably increased. Now, the steam oven did not kill all the organisms, but spared those capable of forming spores, i. e. sterilisation was only partial.

Partial sterilisation by means of volatile antiseptics gave the same result. The conclusion was drawn that partial sterilisation increased the bacterial activity, and consequently the amount of decomposition. The increased quantity of plant food thus formed is shown by the amounts taken up by the plant. Table I contains a typical series of results:

TABLE I. — *Weight and Composition of Crops grown on Partially Sterilised Soils.*

	Dry Weight	Percentage Composition of Dry Matter			Weight of Food taken by the Plant from Soil, gms.		
	Grams	N	P <sub>2</sub> O <sub>5</sub>	K <sub>2</sub> O	N	P <sub>2</sub> O <sub>5</sub>	K <sub>2</sub> O
<i>Buckwheat :</i>							
Untreated Soil . . . .	18.14	2.75	1.81	5.62	0.499	0.339	1.019
Soil treated with Carbon Disulphide . .	23.27	3.15	2.34	5.97	0.733	0.544	1.389
<i>Mustard :</i>							
Untreated Soil . . . .	15.88	2.30	1.00	4.20	0.367	0.159	0.668
Heated Soil . . . . .	24.33	4.43	2.08	5.02	1.077	0.506	1.221

This experiment confirmed the earlier results of OBERLIN and others.

Further investigations led to the following conclusions:

i. — Partial sterilisation of soil, i.e. heating to a temperature of 60° C. or more, or treatment for a short time with vapours of antiseptics such as toluene, causes first a fall, then a rise in bacterial numbers. The rise sets in soon after the antiseptic has been removed and the soil conditions are once more favourable for bacterial development; it goes on till the numbers considerably exceed those present in the original soil. (Table II).

TABLE II. — *Numbers of Bacteria and Amounts of Ammonia Production in Partially Sterilised Soils.*

	Number of Organisms of Dry Soil in millions, Gelatin Plate Cultures			Ammonia produced in 9 days, in parts per million of dry soil
	At beginning	After 9 days	Increase during 9 days	
Untreated Soil . . .	6.7	9.8	3.1	0.7
Soil heated to 98° .	0.0003	6.3	6.3	3.2
Soil treated with Toluene, which was subsequently evaporated . . . . .	2.6	40.6	38.0	17.1
Soil treated with Toluene, which was left in . . . . .	2.3	2.6	0.3	5.5

This confirmed the earlier results of HILTNER and STÖRMER.



2. — Simultaneously there is a marked increase in the rate of accumulation of ammonia. This sets in as soon as the bacterial numbers begin to rise, and the connection between the two quantities is normally so close as to indicate a causal relationship; the increased ammonia production is, therefore, attributed to the increased numbers of bacteria. There is no disappearance of nitrate: the ammonia is formed from organic nitrogen compounds.

3. — The increase in bacterial numbers is the result of improvement in the soil as a medium for bacterial growth and not an improvement in the bacterial flora. Indeed, the new flora *per se* is less able to attain high numbers than the old. This is shown by the fact that the old flora, when reintroduced into partially sterilised soil, attains higher numbers and effects more decomposition than the new flora. Partially sterilised soil plus 0.5 per cent of untreated soil, or an unfiltered aqueous extract of untreated soil, soon contains higher bacterial numbers per gram and accumulates ammonia at a faster rate than partially sterilised soil alone.

4. — The improvement in the soil brought about by partial sterilisation is permanent, the high bacterial numbers being kept up even for 200 days or more. The improvement, therefore, did not consist in the removal of the products of bacterial activity, because there is much more activity in partially sterilised soil than in untreated soil. Further evidence is afforded by the fact that a second treatment of the soil some months after the first produces little or no effect.

It appears from (3) and (4) that the factor limiting bacterial numbers in ordinary soils is not bacterial, nor is it any product of bacterial activity, nor does it arise spontaneously in soils.

5. — But if some of the untreated soil is introduced into partially sterilised soil, the bacterial numbers, after the initial rise, see (3), begin to fall. The effect is rather variable, but is usually more marked in moist soils that have been well supplied with organic manures; e. g. in dunged soils, greenhouse soils, sewage farm soils, etc. Thus the limiting factor can be reintroduced from untreated soils. (Table III).

6. — Evidence of the action of the limiting factor in untreated soils is obtained by studying the effect of temperature on bacterial numbers. Untreated soils were maintained at 10°, 20°, 30° C., etc., in a well moistened aerated condition, and periodical counts were made of the numbers of bacteria per gram. Rise in temperature rarely caused any increase in bacterial numbers; sometimes it had no action, and often it caused a fall.

But after the soil was partially sterilised the bacterial numbers showed the normal increase with increasing temperatures. Similar results were obtained by varying the amount of moisture but keeping the temperature constant (20° C.) The bacterial numbers in untreated soils behaved erratically, and tended rather to fall than to rise when the conditions were made more favourable to trophic life; on the other hand, in partially sterilised soil, the bacterial numbers steadily increased with increasing moisture

TABLE III. — *Effect of Reinfesting Untreated Soil into Partially Sterilised Soil.*

	Gain in Ammonia and Nitrate in 57 days	Number of Bacteria in millions per gram of Dry Soil		
		After 20 days	After 38 days	After 61 days
Toluened Soil alone.	24.3	28.0	31.8	60.1
Toluened Soil + un-sterilised aqueous extract from Untreated Soil . . .	43.7	61.3	45.2	166.6
Toluened Soil + 5 % Untreated Soil. .	20.3	32.0	46.9	48.0

content. Again, when untreated soils are stored in the laboratory or glass house under varying conditions of temperature and of moisture content the bacterial numbers fluctuate erratically; when partially sterilised soils are thus stored the fluctuations are regular.

7. — When the curves obtained in (6) are examined, it becomes evident that the limiting factor in the untreated soils is not the lack of anything (1) but the presence of something active.

8. — This factor, as already shown, is put out of action by anti-septics and by heating the soil to 60° C., and once out of action it does not reappear. Less drastic methods of treatment put it out for a time, but not permanently: e. g., heating to 50°, rapid drying at 35°, treatment with organic vapour less toxic than toluene (e. g. hexane), incomplete treatment with toluene. In all these cases the rise induced in the bacterial numbers per gram is less in amount than after toluene treatment, and is not permanent; the factor sets up again. As a general rule, if the nitrifying organisms are killed, the limiting factor is also extinguished; if they are only temporarily suppressed, the factor is also only put out for a time.

9. — The properties of the limiting factor are:

- a) It is active and not a lack of something else, see (7).
- b) It is not bacterial, see (3) and (4).
- c) It is extinguished by heat or poisons, and does not reappear if the treatment has sufficed to kill sensitive and non-spore-forming organisms; it may appear, however, if the treatment has not been sufficient to do this.
- d) It can be reintroduced into soils from which it has been permanently extinguished by the addition of a little untreated soil.
- e) It develops more slowly than bacteria, and for some time may show little or no effect; then it causes a marked reduction in the numbers

(1) The soils varied from medium loams to rich glasshouse soils well provided with fertilising constituents.

of bacteria, and its final effect is out of all proportion to the amount introduced.

f) It is favoured by conditions favourable to trophic life in soil, and finally becomes so active that the bacteria become unduly depressed. This is one of the conditions obtaining in glasshouse "sick soils" (1).

It is difficult to see what agent other than a living organism can fulfil these conditions. Search was therefore made for larger organisms capable of destroying bacteria, and considerable numbers of protozoa were found. The ciliates and amoebae are killed by partial sterilisation. Whenever they are killed, the detrimental factor is found to be put out of action, the bacterial numbers rise and maintain a high level. Whenever the detrimental factor is not put out of action, the protozoa are not killed. To these rules we have found no exception. Further, intermediate effects are obtained when a series of organic liquids of varying degrees of toxicity is used in quantities gradually increasing from small ineffective up to completely effective doses. The detrimental factor is not completely suppressed but sets up again after a time, so that the rise in bacterial numbers is not sustained. But the parallelism with ciliates and amoebae is still preserved: they are completely killed when the detrimental factor is completely put out of action; they are not completely killed, but only suppressed to a greater or less degree, when the detrimental factor is only partly put out of action.

Now this similarity between the properties of the detrimental factor and the protozoa is not proof that the protozoa constitute the limiting factor, but it affords sufficient presumptive evidence to justify further examination. The obvious test of adding cultures of protozoa to partially sterilised soil was made, but no depression in bacterial numbers was obtained; instead there was sometimes a rise. But in view of the history of investigations on malaria and other protozoan diseases no great significance was attached to this early failure.

At this stage the investigation was divided into two parts:

1. — The study of the soil protozoa.
2. — The effects of the limiting factor on the biochemical processes on the soil.

No attempt had ever been made in any of the above experiments to identify the protozoa, or even to ascertain whether any particular form existed in the soil in the trophic state or as cysts. The variety of forms was considerable, and it soon became evident that a definite protozoological survey of the soil was required.

This was accordingly put in hand. In order to give the survey as permanent a value as possible the investigations were not confined to the narrow issue whether soil protozoa do or do not interfere with soil bacteria, but they were put on the broader and safer lines of ascertaining whether a trophic protozoan fauna normally occurs in the soil, and, if

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(1) This is dealt with fully in J. Agric. Sc. V (1912), 27-47, 86-111.



so, how the protozoa live, and what is their relation to other soil inhabitants.

The first experiments were made by GOODEY (1) mainly with ciliates, and indicated that these protozoa were present only as cysts. Subsequent investigations, however, by MARTIN and LEWIN established the following conclusions (2):

1. — A protozoan fauna in a trophic state normally occurs in soils.
2. — The trophic fauna found in the soil differs from that developing when soil is inoculated into hay infusions: the forms which appear to predominate in the soil do not predominate in the hay infusions, and vice versa, the forms predominating in the hay infusions do not necessarily figure largely in the soil.
3. — The trophic fauna is most readily demonstrated and is therefore presumably most numerous, in moist soils well supplied with organic manures, e. g. in dunged soils, greenhouses soil, sewage "sick" soils, and especially glasshouse "sick" soils.

Two methods were used for demonstrating the existence of the trophic fauna. The simplest is to place some of the soil in a porcelain dish and cover it with a fixative solution delivered through a funnel, the fixative solution being either picric acid or mercuric chloride dissolved in water till saturation is reached, and then mixed with an equal volume of alcohol. In a short time a film is formed which can be picked up on cover slips and mounted in the usual way: it contains many of the organisms in the form in which they actually existed in the soil. Unfortunately, the method is not completely under control, and sometimes for no apparent reason it fails to work.

The second method is to blow air through a mixture of soil and water contained in a long glass tube (50 cc. long) and allow the bubbles to break against a cover slip coated with agar. Some of the protozoa detach themselves from the soil particles, are caught up in the bubbles, and then adhere to the agar on the slip.

By this method MARTIN and LEWIN found that the dominant forms in a rich cucumber soil were amoebae: one was of the limax type to which they gave the name *Vahlkampfia soli*, one of the lamellipodian type which they called *Amoeba cucumis*, and there were two types of Thecamoebae, a *Euglypha* and a *Trinema*. A garden soil of poorer quality contained a more varied fauna, both of amoebae and thecamoebae, but apparently in smaller numbers. Small monads also were numerous.

Finally, the latest experiments by GOODEY have shown that when this trophic fauna is introduced into partially sterilised soils the bacterial numbers are brought down. The earliest attempts to carry out this experiment failed, as already stated, only one successful experiment by CUNNINGHAM being on record. It was not till GOODEY discovered the conditions for successful inoculation that it could be carried out. GOODEY

(1) GOODEY, Roy. Soc. Proc., B. 6 (1914), 417-451.

(2) MARTIN & LEWIN, Phil. Trans., 205 (1914), 77-94; and J. Agric. Sci. 7 (1915), 106-119.

found that mass cultures of protozoa failed when introduced direct from a culture medium into partially sterilised soils, but succeeded when introduced through the medium of some untreated soil. In these circumstances the protozoa lived, and numbers of bacteria were reduced. The protozoa used in these investigations were amoebae of the limax type, these being the forms common in the soil.

Thus it was shown that these protozoa lead an active life in the soil, and that one result of their activity is to keep down the numbers of bacteria.

The further problem was put in hand of finding out how numerous are the protozoa in the soil, and how this activity varies with the different conditions obtaining in the field. A dilution method is adopted somewhat similar to that used for enumerating the soil bacteria. The investigation is still only in its early stages, but already it is clear that amoebae and flagellates are present in at least tens of thousands per gram of soil, while ciliates can only be found in hundreds. Some of the organisms appear to be new to science, and many of them are of considerable interest.

The other part of the investigation consists in studying the effects of these detrimental organisms on the process of food production in the soil. For this purpose it is not necessary to find what the detrimental organisms are; it is sufficient to divide the soil organisms into two groups in their relations to the processes of food production; a useful group and a detrimental group. The latter are, more generally speaking, more readily killed than the former. Conditions that are harmful to active life in the soil tend, therefore, to reduce their numbers and lead ultimately to an increased activity of the useful bacteria. On the other hand, conditions favourable to active life tend to keep up the detrimental organisms and therefore to reduce the useful bacterial activity. It is thus possible to account for a number of obscure paradoxical effects that have hitherto caused considerable perplexity. It has already been observed by practical men in various countries that certain soil conditions harmful to the growth of organisms were ultimately beneficial to productiveness, such as long continued and severe frosts, long drought (especially if associated with hot weather), sufficient heat, treatment with appropriate dressings of lime, gas lime, carbon disulphide, etc.

Further it has been observed that conditions which are undoubtedly favourable to life, such as the combination of warmth, moisture, and organic manures found in glasshouses, lead to reduced productiveness after a time. This phenomena is spoken of as "sickness" by the practical man.

It is difficult to account for these results on the old view that the useful plant-food making bacteria are the only active microorganisms in the soil. On the other hand, the new view that detrimental organisms are also present readily explains the observed facts.

The "sickness" that affects the soil of glasshouses run at a high pitch (such as cucumber houses), and less slowly at a lower pitch (such as tomato houses), has been investigated in some detail owing to its great tech-

nical importance. It was traced to two causes: an accumulation of various pests, and an abnormal development, especially in cucumber houses, of the factor detrimental to bacteria. The properties of this factor show that it is identical in character with that present in normal soil, and strongly indicate its biological nature. No evidence of a soluble toxin could be obtained. On the other hand, some remarkably interesting protozoa and allied organisms have been picked out from these sick soils and described by MARTIN, LEWIN and GOODEY. Finally, it has been shown that the whole trouble can be cured by partial sterilisation, and methods suitable for large scale work have been investigated and are now in use in practice. Steam heat at present proves most convenient, but the suitability and detailed effects of lime have been studied by HUTCHINSON and M'LENNAN, and of various antiseptics by BUDDIN.

On the technical side the investigation is being developed with a view to the discovery of cheap methods of partial sterilisation. Speaking generally, this type of work is done much better by practical men on their own holdings than at scientific institutions.

It was of course hopeless to try and interest the farmer in any method of partial sterilisation as the cost would be prohibitive, but it was not difficult to interest some of the market gardeners working under glass. Demonstrations made in their nurseries at once appealed to them, and showed that the results were worth having. In consequence of the many modifications they have introduced, the costwork of ing has greatly fallen and partial sterilisation is now extensively practised both as a cure for sick soils and as a method of killing the soil insect and fungoid pests that cause so much havoc in the industry. A special Experiment Station has been set up in the district where the various problems arising out of the industry can be dealt with. One of these is the full investigation of the various methods of partial sterilisation both by chemicals and by heat.

#### LIST OF PAPERS ON PARTIAL STERILISATION.

- E. J. RUSSELL and H. B. HUTCHINSON. The Effect of Partial Sterilisation of Soil on the Production of Plant Food. (*Journal of Agric. Science*. 1909. Vol. 3, pt. 2).
- T. GOODEY. A Contribution to our Knowledge of the Protozoa of the Soil. (*Proceedings of the Royal Soc.* 1911. Vol. 84 B, no. 570, pp. 165-180).
- E. J. RUSSELL and J. GOLDING. Investigations on "Sickness" in Soil. I. Sewage Sickness. (*Journal of Agric. Science*. Vol. 5, pt. 1, 1912).
- E. J. RUSSELL and F. R. PETHERBRIDGE. Investigations on "Sickness" in Soil. II. "Sickness" in Glasshouse Soils. (*Journal of Agric. Science*. 1912. Vol. 5, pt. 1).
- E. J. RUSSELL and F. R. PETHERBRIDGE. Partial Sterilisation of Soil for Glasshouse Work. (*Journal of Board of Agric.* 1913. Vol. 19, no. 10.)
- E. J. RUSSELL and H. B. HUTCHINSON. The Effect of Partial Sterilisation of Soil on the Production of Plant Food. Part II. The Limitation of Bacterial Numbers in Normal Soils and its Consequences. (*Journal of Agric. Science*. 1913. Vol. 5, pt. 2).
- E. J. RUSSELL. The Complexity of the Microorganic Population of the Soil. (Reprinted from *Science*. N. S. 1913. Vol. 37, no. 953, pp. 519-522).



- A Lecture delivered by E. J. RUSSELL at the Conference held in Essex Hall, London. Nov 20. 1912. Chrysanthemum Growing in Partially Sterilised Soils. (National Chrysanthemum Soc.).
- E. J. RUSSELL and F. R. PETHERBRIDGE. On the Growth of Plants in Partially Sterilised Soils. (Journal of Agric. Science. 1913. Vol. 5, pt. 3.)
- H. B. HUTCHINSON. The Partial Sterilisation of the Soil by means of Caustic Lime. (Journal of Agric. Science. 1913. Vol. 5, pt. 3).
- E. J. RUSSELL and W. BUDDIN. The Action of Antiseptics in increasing the Growth of Crops in Soil. (Reprinted from the Journal of the Soc. of Chemical Industry, London Section. 1913).
- W. BUDDIN. Results of Experiments with Chrysanthemums on Partially Sterilised Soils during 1913. (Transactions of the National Chrysanthemum Soc. 1913. pp. 21-24).
- C. H. MARTIN and K. R. LEWIN. Some Notes on Soil Protozoa. (Phil. Trans. 1914. Vol. 205 B, pp. 77-94).
- E. J. RUSSELL. Third Report on the Partial Sterilisation of Soils for Glasshouse Work. (Journal of Board of Agric. 1914. Vol. 21, no. 2, pp. 97-116).
- W. BUDDIN. Partial Sterilisation of Soil by Volatile and Non-Volatile Antiseptics. (Journal of Agric. Science. 1914. Vol. 6, pt. 4, pp. 417-451).
- E. J. RUSSELL and A. APPLEYARD. The Atmosphere of the Soil: its Composition and the Causes of Variation. (Journal of Agric. Science. 1915. Vol. 7, pt. 1. pp. 1-48).
- C. H. MARTIN and K. R. LEWIN. Notes on Some Methods for the Examination of Soil Protozoa. (Journal of Agric. Science. Vol. 7, pt 1, pp. 106-119, 1915).
- E. J. RUSSELL. Soil Protozoa and Soil Bacteria. (Proceedings of Royal Soc. 1915. Vol. 89B. pp. 76-82).
- T. GOODEY. Further Observations on Protozoa in Relation to Soil Bacteria. (Proceedings of the Royal Soc. 1916. Vol. 89B. pp. 297-314).

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SECOND PART.  
ABSTRACTS

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AGRICULTURAL INTELLIGENCE

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GENERAL INFORMATION.

DEVELOPMENT  
OF  
AGRICULTURE  
IN DIFFERENT  
COUNTRIES

398 - **Agricultural Progress in the Province of Quebec, Canada, in 1915-1916.** — *Report of the Minister of Agriculture of the Province of Quebec, 1916, 1 Vol., pp. xviii.*  
+ 308. Quebec, 1916.

The Report of the Minister of Agriculture to the Lieutenant Governor of the Province of Quebec for the year 1915-1916 gives a summary of the work done by the various services, the schools of agriculture and domestic science, and the principal agricultural institutions of the province. It shows the methodical development of the programme mapped out by the Minister of Agriculture 5 years ago, the chief aims of which were to lead the farmer in the way of progress and to give a greater impulse to agriculture.

EDUCATION. — The extent of the progress made may be well appreciated by a consideration of the number of students entered at the 3 principal agricultural schools of the province. The figures for 1915-1916 were as follows :

Macdonald College . . . . .	470	students
Agricultural School of Ste-Anne-de-la-Pocatière . . . . .	365	"
Oka Agricultural Institute . . . . .	175	"

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Total . . . . . 1010 students

Every year new grants are made for the establishment of domestic science courses in convents. Fifty educational institutions now receive such grants and are in a position to give really appropriate instruction to young girls from the country. These courses are very popular. The teachers, both religious and lay, are qualified students of the domestic science schools of Montreal, St. Pascal, Roberval and Sutton. From

1910 to 1916, 121 women teachers followed the vocational normal course of the Provincial Domestic Science School and 83 religious women teachers of 6 different congregations were enabled to follow the course of the 3 other schools.

Thanks to a special grant, the convents of Montebello, Ste-Marie de Beauce, Trois-Pistoles, Frazerville and Drummondville have given summer courses comprising theory and practice, to the people of the district. These courses, of 5 days' duration, were enthusiastically followed, not only by women of the middle and working classes, but also by those of the higher classes. The average daily attendance was over 100. The interest taken in the exhibits of works of all kinds at the Quebec Exhibition clearly proves that the good effects of this instruction are being seriously felt. The chief purpose aimed at is to revive amongst the farmers those domestic industries which formerly brought them good profit and occupied their leisure during the long Canadian winter.

COOPERATION. — The number of cooperative societies organised during the fiscal year was 21, bringing their total up to 162. The amount of business done by the Quebec Cheesemakers' Cooperative Agricultural Society and the Comptoir Coopératif de Montréal, the two principal central cooperative Societies, the former for sales, the latter for purchases, in the year 1916, amounted to \$ 3 000 000 and \$ 150 000 respectively. A group of 25 cooperative societies have formed a federation under the direction of the Abbé Allaire. They are chiefly concerned with sales, and ship their products to the Montreal market. The profits accumulated by the Cooperative Agricultural Society of Yamaska Valley enabled it to pass through the difficulties arising from a poor tobacco crop. The Abattoir School of St. Valier, whilst still preserving its character of a school, is now managed by the Cheesemakers' Cooperative Society, and it is probable that the Cooperative Abattoir of Princeville will also lease its establishment to this Society for a certain number of years. The pupils of the Oka Agricultural Institute have organised a cooperative society that keeps a store for all the articles they require; this will enable them to study in a practical manner the working of cooperative societies.

DAIRY INDUSTRY. — The number of factories at present in the province is 1 991, of which 883 are cheese, 585 butter and 523 combined factories. During the year the production of butter and cheese in these factories amounted to \$ 21 000 000, as opposed to \$ 18 400 000 in the previous year. In 1910, the cream and milk exported amounted to \$ 150 792; they have now reached a figure of \$ 1 455 405. On the London market the pasteurised butter exported by the Quebec Cheesemakers' Cooperative Society was considered as the finest lot of butter received from Canada.

STOCK-BREEDING. — Premiums are distributed to 85 agricultural societies and 710 farmers' clubs, and loans, without interest, are made for the purchase of pure-bred breeding stock. The premiums thus distributed last year amounted to \$ 38 102 50, and the loans to \$ 10 196 44. The four principal agricultural exhibitions that form what is called the St.



Lawrence Valley Circuit: Quebec, Sherbroke, Three Rivers and Valley-field, receive a yearly total grant of \$ 30 000. Over 60 agricultural associations hold county exhibitions. The legislature passed a new law last year to give sheep breeders more protection against dogs, and it is hoped that this will help to increase the number of sheep in the province. Notwithstanding the decrease that has been felt for the last 15 years, the province of Quebec occupies the second place among all the provinces with an average of 4 sheep per farm.

**HORTICULTURE.** — This branch, of which the staff is composed of 17 experts, is devoted particularly to promoting the progress of arboriculture, horticulture, floriculture, and the industries derived therefrom: 1) by establishing and superintending demonstration fields or stations intended to popularise the employment of the best methods of cultivation; 2) by giving to private initiative the support or direction which it needs by practical demonstrations, lectures or publications; 3) by organising horticultural societies and making them benefit by exceptionally advantageous offers with the view to inciting the producers to associate, develop the industrial activity of the members and prepare the way for cooperation.

**POULTRY-KEEPING.** — There are 25 poultry-raising stations, which, with the aid of Branch instructors, spread proper methods of poultry-raising. In addition, grants have been made for teaching poultry raising to country school children. Pure-bred eggs are distributed among them, and they are given practical lessons relating to poultry-keeping and the cultivation of vegetables and forage capable of feeding poultry economically. The export of eggs, which had been abandoned owing to the extraordinary increase in consumption has, for some time past, revived in an encouraging manner, in spite of the continual rise in prices.

**APICULTURE.** — In 1915-1916 the 7 apiary inspectors made 2 177 visits. The Italianisation of the beehives was encouraged by the distribution of 1 000 Italian queens in 195 beehives at 55 cents each, i. e. at half purchase price. In the 40 counties the bees made 2 561 977 lbs. of honey; this represents a value of \$ 291 050 80.

**AGRONOMISTS.** — There are 12 agronomists, of whom 6 have assistants. As soon as the finances of the province and the number of agricultural experts allow it, it is hoped to establish agricultural bureaux in all the agricultural counties.

The total money spent by the Department of Agriculture during the fiscal years was \$ 725 747.96.

The policy of "Return to the Land" commended by the Government is strongly seconded by all the educational institutions. The education based on agriculture which is given to the children has created a current of new ideas in agriculture and attracted towards it the attention of all classes of the population.

399 - **Agriculture in Fiji.** — *Colonial Annual Reports, Fiji*, No. 837, Report for 1915. London, August, 1916.

The following figures presented in the last Report of the acting Governor of Fiji do not include native cultivation and so far as Europeans are concerned, can only be taken as estimates, owing to the disinclination of some of the planters to furnish particulars of their cultivation.

*Sugar.* — The number of acres under sugar cane in 1915 was 62 308 against 62 852 in 1914 and the number of tons of cane produced was 833 883 in 1915 as against 874 164 in 1914.

*Coconuts.* — The area under coconuts cultivated by Europeans was estimated at 45102 acres in 1915 as against 42 492 acres in 1914. The cultivation of coconuts continues to grow notwithstanding extraordinary conditions which, during the year, have unsettled and restricted the copra market.

The experiments at Lancela being conducted by the Department of Agriculture with a view to improving the condition of coconut trees on Viti Levu were continued throughout the year. A decided benefit has followed the cultivation of the trees and the application of manures. It has been arranged to extend these experiments by planting plots of trees at various places on the coast and carefully selected seed nuts have been collected and distributed.

*Bananas.* — The area under bananas cultivated by Europeans was estimated at 5 782 acres as against 666 7 acres in 1914, and the prices obtained for bananas during the year were most satisfactory.

*Pineapples, mandarines and kumalas.* — During the year 1 225 cases of pineapples, 3 159 cases of mandarines and 185 sacks and 30 cases of kumalas, the sweet-potato of Fiji, were shipped to Australia and New-Zealand.

*Cotton.* — As in previous years, cotton produced by planters to whom seed had been supplied, was purchased and ginned by the Agricultural Department for ultimate delivery and sale to the British Cotton Growing Association. At the experimental stations cotton was the chief crop. It was originally intended to continue experiments in the cultivation of cotton for a period of ten years. Nine years have now been completed and the results from an agricultural point of view are to be considered as satisfactory.

*Rubber.* — Rubber to the value of £ 3 464 was exported in 1915 as against £ 463 during the previous year. It is hoped that the exports of this produce will increase.

*Land grants.* — The total amount of land alienated in 1915 was 654 022 acres comprising crown and native grants and crown and native leasehold. The area held by the crown open to settlement amounts to 92 499 acres, and unalienated land including land occupied by Fijians amounts to 4 011 879 acres in extent, the total area of the Colony being 4 758 400 acres.

In addition to these native leaseholds referred to above, 439 leases for 9 874 acres were surveyed during 1915, but the leases remained unregistered while 690 leases for 11 964 acres have been approved but have not yet been surveyed.

The number of applications to lease land received in 1915 was the



greatest yet recorded, but the area was less than in 1914, which is probably due to a falling off in the number of applications received from Europeans.

Regulations were made by the Governor in Council on the 26th June 1915, prescribing the conditions on which consent is granted for leases of crown and native lands.

**400 - Swine as Agents in the Spreading of Sleeping Sickness in the Valley of Inkissi, Central Belgian Congo.** (1). — GEGGIO, G., in *Bulletin de la Société de Pathologie exotique*, Vol. X, No. 2, pp. 113-117; February 14, 1917.

From May to November 1914, 94 pigs from the Inkissi Valley district were examined at the market of Kisantu. Thirty-six of these pigs (38 %) were found to be suffering from trypanosomiasis (*Trypanosoma congolense*). High as this percentage is, it must be considered below the actual figure because as trypanosomes occur only in very small numbers in the blood of pigs, an examination of the blood of infected animals, unless repeated many times, does not always reveal their presence. The whole of the Inkissi Valley has become infected, from the railway bridge (163 miles) to the Portuguese Congo.

From an economic point of view swine trypanosomiasis causes no loss to the owners, as animals attacked by it breed normally, show no outward signs of disease and may be in very good condition.

There is no direct correlation between human trypanosomiasis (sleeping sickness) and that of the pig; in the same district, the one may be very widespread, the other almost absent. In the Kisanthu district in 1915, 7 per 1000 of the natives suffered from the disease, whereas 32 per cent of the swine were attacked. Indirectly, however, the districts where pig-breeding is increasing, are threatened with grave risks of infection. Herds of pigs are an easy and continual source of food for *Glossina* and act both as breeding centres and carriers. One person only suffering from sleeping sickness in a village is a constant source of infection for others. The Tumba Mani district, for example, offers ideal natural conditions for resisting this disease, yet, as a result of extended pig-breeding, it was invaded and ravaged by the sickness.

The natives make a considerable profit from pig-breeding which, since the animals are left free to wander round and find their own food, costs nothing. It seems impossible, under these circumstances, to stop pig-breeding, or even to restrict it to certain given areas in each village. The only method of checking the disease seems, therefore, to be the systematic examination of the population for human trypanosomiasis.

**401 - Destruction of Mosquito Larvae in Rice Fields by Carp, an Effective Measure against Malaria.** — See No. 472 of this *Bulletin*.

(1) See also *B.*, March, 1917, No. 216

(Ed.).



402 - **Agricultural Instruction in Canada** (1). — JAMES, C. C. in *Sixth Annual Report of the Commission of Conservation (Committee on Lands)* pp. 1-15. Ottawa, 1915.

On the advice of the HON. MARTIN BURRELL, minister of Agriculture, the Dominion Government, in 1913, appropriated \$ 10 000 000 to be expended on agricultural instruction during a period of 10 years. For the first year, 1913-1914, \$ 700 000 was set aside — for 1914-1915, \$ 800 000 — for 1915-1916, \$ 900 000, so that in 1917 the maximum of \$1 100 000 will be reached unless the Government should think well to add to that amount.

*Purpose of Appropriation.* — This money is set aside for the purposes of "education instruction and demonstration." As under the "British North America Act" education is a prerogative of the provinces, and the Dominion Government is not supposed to interfere in the matter, this money is handed over to the various provinces to be expended through their Departments of Agriculture and Education. The Dominion Department of Agriculture confines itself to aiding in an advisory capacity and to supervising the work.

*Basis of Division.* — The basis of division among the provinces was as follows: First of all \$ 20 000 a year were set aside for 2 veterinary colleges; one in Toronto, affiliated with the University of Toronto, and one in Montreal, affiliated with Laval University, for these colleges provide instruction for all the provinces alike.

Each province has received \$ 20 000 irrespective of population, area, or natural production.

*Agricultural Education in Prince Edward Island.* — Prior to 1912, this island had practically no agricultural organization. All the agricultural instruction work was done by the Dominion Department of Agriculture. Thanks to new funds, it has been possible to institute a definite course in agriculture (including live-stock, field crops and dairying etc.) at Prince of Wales College. An annual exhibition has been organized at Charlottetown, where a hall has been built in which agricultural lectures can be held. At the present time, 200 or 300 students and farmers are receiving instruction there on various lines. Three departmental officers have been placed in charge of the 3 counties, and Womens' Institutes have also been organised. The teaching of nature study and agriculture has been undertaken in the public schools. The Secretary for Agriculture is now assisted by a permanent staff of 5 members. The budget for 1917 will amount to \$ 31 754.

*Progress in Agriculture in Nova Scotia.* — The Provincial Secretary for Agriculture is also the Principal of the Agricultural College at Truro, so that the agricultural life of Nova Scotia is centred at Truro, and not at Halifax. In the former town, there is a normal school, an Agricultural College and the headquarters of all the provincial agricultural officials. Attached to the staff of the normal school there is a Director of Rural Education, he instructs the teachers-in-training in agricultural and nature study

(1) See also B. 1914 pp. 655-662. Original Article by Prof. S. B. MACCREADY — "The Present Condition of Agricultural Education in Canada", and No. 398 of this *Bulletin* (Ed.)

and has a general supervision of work throughout the province. By raising the salaries of the instructors engaged in this new work, the rural schools have been able to retain able men who were before attracted by pecuniary advantages to other provinces. Five permanent offices of instruction have been created in this Province and the Womens' Institute movement has been encouraged, and is now carried on with funds from the Federal grant. The latter in 1917 will amount to \$ 81 719.

*Agricultural Progress in New Brunswick.* — As a result of an arrangement made with the executor of the "Fisher Estate", the "Fisher Vocational School" was erected at Woodstock. This school is equipped for teaching agricultural, manual training and domestic science. A second school has been founded at Sussex; a third in the northern portion of the province is in prospect, while a fourth will perhaps be built at Fredericton. Rural education is under the direction of an Inspector who is carrying on enthusiastically the work of introducing agriculture into the rural schools of the province. In addition, the salaries of 13 instructors directing all the agricultural instruction in the province are paid out of the Federal grant. The Womens' Institutes also have been encouraged and they are growing in numbers and extending their sphere of usefulness. The Federal grant in 1917 will amount to \$ 64 118.

*Agricultural Education in Quebec.* — In this province, there are 3 agricultural schools: the Oka Agricultural Institute on the Trappist Estate at Lake of Two Mountains; the School of Ste-Anne-de-la-Pocatière in Kamouraska County, below Quebec, and Macdonald College, near Montreal.

The school at Ste. Anne is the oldest agricultural school on the American continent. It is being enlarged, as is also the Oka Agricultural Institute, and the new buildings will double the accommodation now existing. The sum of \$ 5 000 a year is being taken for the 10 years of the Act to pay the cost of these buildings. The Oka Institute has secured the collaboration of PROF. HANSEN of Copenhagen, PROF. WATCH of Geneva, and PROF. NAGANT of Louvain. At Macdonald College, 8 additional instructors have been appointed, chiefly to carry on the extension work. Many other lines have been inaugurated and extended by the Provincial Department — fruit culture — dairying — tobacco-growing — bee-keeping — drainage and domestic science. Further, 27 offices have been created in Quebec, and 27 permanent instructors appointed; in addition to these, there were many temporary assistants during the summer. The grant in 1917 will amount to \$ 271 068.

*Agricultural Instruction in Ontario.* — Ontario has more lines of agricultural work organised than any other province, therefore the Federal grant has been mainly employed in extending, or enlarging, the organisation already in operation, by appointing new agricultural instructors. In all, 49 have so far been appointed. There have been created a department of co-operation and marketing and also a department of vegetable-growing. The 20 new offices that have been created by the help of the Federal grant each have an instructor and an assistant, which allows of the work of instruction being carried direct to the farmers on their own farms. The agricul-



tural College at Guelph now possesses the finest field husbandry building on the American Continent. A great impetus has been given to plot-growing work done by boys and girls on the farm, the products being exhibited at fairs held in the schools. The pupils show great enthusiasm for these competitions which have been extended to stable, poultry and dairy produce, and are spreading rapidly throughout all the provinces of Canada.

At the Guelph Agricultural College, 65 farmers sons are given a two weeks' free course, as a prize for growing potatoes in acre plots in their own county or district. The boys' expenses to that college are paid out of the Federal grant. This grant in 1917 will be brought up to \$ 336 319, and a portion of this will be devoted to the extension of agricultural instruction in rural schools. In 1915, the sum thus added to the grant of the Provincial Department of Education was \$ 30 000.

*Agricultural Education in Manitoba.* — The Manitoba Department of Agriculture handles all the Federal grant (which will amount in 1917 to \$ 77 144) itself, and none of it goes to the Agricultural College, or the Education Department for teaching agriculture in the public schools. The Department has for some time carried on the work of teaching nature study and agriculture in schools under Mr. J. H. WATSON. The Provincial Department spends most of the money obtained from the Federal grant in demonstration farms and demonstration trains. Their purpose is to organise these demonstration farms all over Manitoba with the view of discouraging the practice of growing wheat only, and in the hope of promoting mixed farming (stock-breeding and crop-growing).

*Methods applied in Saskatchewan.* — This province divides the grant it receives (which will be \$ 81 733 in 1917) equally between the Faculty of Agriculture of the University of Saskatchewan, and the Department of Agriculture. The University of Saskatchewan has thus been enabled to appoint 13 additional professors and instructors, mainly for the purpose of extension work. In addition, 8 provincial instructors attached to the Agricultural Department have been appointed. The province is about to appoint a director of rural education and 1 or 2 directors of domestic science.

*Agricultural Instruction in the Province of Alberta.* — This province possesses 6 demonstration farms and it was decided to attach an agricultural school to 3 of them. On account of the excellent work done by these schools, the Canadian Pacific Railway Co. intend to give them some substantial assistance. There are 15 instructors in agriculture provided for out of the Federal grant, and the Province hopes to increase the number. The grant will reach \$ 66 971 in 1917.

*Agricultural Instruction in British Columbia.* — The Provincial Department has been using its Federal Grant mostly for field competitions and for boys' and girls' competitions (in cultivating small plots). The sum of \$ 15 000 has recently been set apart for agricultural instruction in the public schools under the direction of Mr. J. W. GIBSON. Nine other agricultural instructors have been appointed.

The Federal grant to British Columbia will amount to \$ 69 202 in 1917.



In short, the Federal grants have furnished to the different provinces about \$ 250 000 for buildings and equipment for agricultural instruction and they have provided for 155 permanent instructors in the different provinces who have organized or extended practical agricultural teaching in all the provinces of Canada.

EXPERIMENTAL  
AND  
ANALYTICAL  
WORK

403 - **Separation and Identification of Food Colouring Substances.** — MATHEWSON, W. E. in *United States Department of Agriculture, Bulletin* No. 448, 56 pp. Washington, February 15, 1917.

The scheme of analysis of dyes described in this bulletin embraces about 130 distinct chemical compounds. This number comprises practically all those coal-tar colours (except a few entirely obsolete nitro dyes) which have been mentioned in the literature as having been found in food products and those stated by chemists to be suitable for the colouring of foods.

The scheme of separation described in the above-mentioned bulletin is designed to meet actual conditions, one of which is the relatively more frequent occurrence of the 8 colours which the United States Department of Agriculture permits to be used in food (Food Inspection Decisions, Nos. 76 and 164) — Amaranth, Ponceau 3 R, Erythrosin, Orange I, Naphthol yellow S, Tartrazin, Light green, S. F. yellowish, and indigo disulphoacid. The separation method is mainly based upon the employment of immiscible solvents.

## CROPS AND CULTIVATION.

SOIL PHYSICS,  
CHEMISTRY  
AND  
MICROBIOLOGY

404 - **New Experiments on Soil Sterilisation in France.** — MIÈGE, M., in *Comptes Rendus hebdomadaires des Séances de l'Académie des Sciences*, Vol. 164, No. 9, pp. 362-365. Paris, February 26, 1917.

Since 1914, the writer has made new experiments with regard to the fertilising influence and antiseptic value of the sterilisation of soils (1). Great attention should be given to the study of this subject, not only in view of the increased yields which may be expected, but also because the sterilisation of the soil greatly decreases the large losses suffered annually from the attacks of epiphytic parasites.

Two sets of experiments were carried out ; the first in open fields and in gardens on : potatoes, buckwheat, beans, tomatoes, carrots, leeks ; the second under glass and in the open, chiefly on tomatoes, but also on cucumbers and carnations.

The following antiseptics were used during the last two years : - toluene - formol - lysol - shale oils - wood charcoal - potassium permanganate - hydrogen peroxide - calcium hypochlorite - sulphur - sulphides, etc. Most of these were applied before sowing, a few were applied only after sprouting, whereas others were used in the preparation of vegetable mould or composts.

(1) See also: *The Partial Sterilisation of Soil*, by E. J. RUSSELL, pp. 673-681 of this *Bulletin*.

FIRST SERIES OF EXPERIMENTS. — The following results were obtained in clayey loam plots measuring 20 square metres each :

TABLE I. — *Yields (in Kilograms) obtained in the 1st series of experiments.*

Antiseptic Used	Beans	Tomatoes	Carrots	Potatoes	Buckwheat (green)
Toluene . . . . .	—	—	37.100	13.760	45
Carbon bisulphide . . . . .	—	—		12.880	44
Hydrogen peroxide . . . . .	—	—		12.720	—
Lysol . . . . .	—	—	42.500	—	—
Formol . . . . .	—	—		12.740	43
Potassium permanganate . . . . .	0.950	—		13.020	—
Copper sulphate . . . . .	—	—	—	14.120	—
Sulphur . . . . .	—	—	—	16.920	43
Calcium hypochlorite . . . . .	1.250	50.500	—	—	46
Wood charcoal . . . . .	0.900	—	—	12.720	—
<i>Controls</i>	<b>0.550</b>	<b>35.000</b>	<b>14.165</b>	<b>8.440</b>	<b>40</b>

The antiseptics had a marked effect, and their application was accompanied, not only by a notable increase in yield, but also by an undeniable decrease in disease and other injuries of the plants treated.

SECOND SERIES OF EXPERIMENTS. — These trials all gave similar results. They were carried out on more than 600 square metres of cultures under glass and more than 1 hectare in the open. These experiments were therefore no longer on a laboratory scale, and as the land was used for commercial purposes to a certain extent, it was necessary that immediate profits be realised.

In these tests, as in the previous ones, the yield was considerably increased and the treatment had a distinctly beneficial effect on the health of the plants. The land and glass-houses used had been devoted to the cultivation of early tomatoes for 15 years. It is obvious that continual intensive cultivation in the same warm and damp surroundings would make the vegetables particularly subject to all diseases, and indeed, in spite of the greatest care and attention, the plants were so infested with parasites, that growth was very seriously compromised and successful cultivation very uncertain. In this case, therefore, peculiar interest was attached to the sterilisation of the soil.

The variety of plant used was more especially the " Joffre ", a type with firm, smooth fruit. The control plots were between the experimental plots, and all were submitted to identical conditions of development. Table II gives the results per glass-house and per hectare (each glass-house had an area of 400 square metres and contained 1600 plants).

TABLE II. — *Yield per Glasshouse and per hectare.*

No. of glass-house	Antiseptic used	Amount used (kilograms)		Yield obtained (kilograms)		
		per glasshouse	per hectare	per glass-house	per plant	per hectare
1	Toluene . . . . .	12	300	3 300	2.062	82 500
	Wood charcoal . . . . .	30	750			
	Carbon bisulphide . . . . .	10	250			
2	Wood charcoal . . . . .	30	750	3 040	1.900	76 000
	Lysol (1st. month) . . . . .	1 per cubic metre	—			
3*	Formol (2nd month) . . . . .	1 " " "	—	2 200	1.375	55 000
	Toluene (2nd month) . . . . .	1 " " "	—			
4	Wood charcoal (1st month) . . . . .	10 " " "	—	2 400	1.500	58 000
5	Lysol . . . . .	5 at 5:1000	125	2 200	1.375	55 000
6	Calcium hypochlorite . . . . .	64	1 500	2 500	1.562	62 500
7	Calcium hypochlorite . . . . .	64	1 500	2 550	1.570	63 750
8**	Copper sulphate . . . . .	10	250	2 100	1.312	52 500
	Wood charcoal . . . . .	20	500			
9	Hydrogen peroxide . . . . .	500 litres at 10:1000	125	2 200	1.375	55 000
	Sulphur . . . . .	10	250			
10	Calcium hypochlorite . . . . .	500 litres at 10:1000	125	3 000	1.875	75 000
	Wood charcoal . . . . .	25	625			
11	Potassium permanganate . . . . .	600 litres at 5:1000	75	2 450	1.530	61 250
12	Formol . . . . .	10 litres at 7:1000 per cubic metre	—	2 350	1.470	58 750
13	Sublimated sulphur . . . . .	20	500	2 150	1.345	53 750
	Wood charcoal . . . . .	25	625			
14	Naphtol B. . . . .	5	125	2 800	1.750	70 000
15	Open air . . . . .	—	—	2 800	1.750	70 000

\* In Composts (pot cultures). — \*\* Mixed.

The highest yield was 3 300 kg. per greenhouse, or more than 2 kg. of fruit per plant and 82 500 kg. per ha. These amounts were obtained with toluene or carbon bisulphide. The lowest yields, obtained from copper sulphate, exceeded 2 100 kg. per glasshouse, that is to say they gave an average of 1.31 kg. per plant and 52 000 kg per ha.

If these results are compared with those obtained the same year at Rennes the following conclusions may be drawn :

1) Soil sterilisation carried out under varied conditions (in the open, in glasshouses, in different soils) for different vegetables has been shown to



exert a definite favourable influence on the yield as well as on the health and value of the products.

2) To a certain extent this action is specific as regards the nature of the chemical substances used and that of the plants treated with them. For example, toluene, then carbon bisulphide, give the best results for the same plant under the same conditions (Paramé tomatoes, under glass), whereas elsewhere, and on other cultures, hypochlorite, sulphur, etc., were found to have the most active and favourable effect.

These results fully confirm those already obtained by the writer (1), as well as those obtained abroad and give further proof of the beneficial action of the antiseptic treatment of soils.

405 - **The Use of Iron in Agriculture.** — MONNIER, A. and KUCZYASKI, I., (Compte rendu de la séance du 5 Octobre 1916 de la Société de Physique et d'Histoire naturelle de Genève) in *Archives des Sciences physiques et naturelles*, Year 122, Vol. XLIII, No. 1, pp. 66-68. Geneva, January, 15, 1917.

Up to the present it has been found impossible to make any positive statement with regard to the use of ferruginous manures on account of the discrepancies in the results obtained. Some years ago the writers, in collaboration with Professor CHODAT found that a very dilute solution of a ferric salt has a marked effect when applied at the beginning of vegetation, whereas, if applied when the plants have already reached a certain stage of development, it has practically no effect. Where favourable results were obtained an increase in the iron content of the plant ash corresponded to an increase in growth. As the soil was naturally rich in ferric oxide it may be assumed that the iron normally in the soil is present in a form difficult to assimilate. In order to explain these divergences, the writers carried out experiments to determine: 1) the degree of solubility of the iron already in the soil; and 2) the changes undergone by ferrous and ferric compounds in arable land.

Soils of normal composition show no trace of iron when washed with pure water or dilute solutions of alkaline carbonates and bicarbonates. The

(1) Cf. MÈGE, EM., "New theories on the fertilisation of soils", in *Comptes Rendus de la Société nationale d'agriculture de France*, March, 1914.

In 1912 and 1913, the writer organised at the National School of Agriculture at Rennes, two sets of experiments, one in bottomless boxes placed in the earth and filled with sandy loam, the other in fields of clayey loam. The plants used were white mustard and two rowed barley. The antiseptics included: - toluene, carbon bisulphide, formaline, chloroform, tar, creosote, acetic ether, naphthol, carbolic acid, mercuric chloride, copper sulphate, baryta, potassium permanganate.

In the case of white mustard the highest yields were obtained with toluene, then with carbon bisulphide; formaline (very small quantities) and tar came next. Baryta, naphthol and creosote were distinctly harmful. Copper sulphate had a deleterious effect in the artificial soil, but a favourable one in the yields. Permanganate proved very active.

Barley gave very similar results; toluene came first, then in order: - carbon bisulphide, formalol, chloroform, tar, weak solutions of carbolic acid. Potassium permanganate was also very active.

following experiments were carried out on soil containing 3.2 % of iron and 6 % of lime :

- 1 % *Acetic Acid* : Nothing dissolved.
- 5 % *Acetic Acid* : The solution contains traces of iron.
- 1 % *Citric Acid* : The solution distinctly gives the reaction for iron
- 1 % *Tartaric Acid* : " " " " " "
- 1 % *Oxalic Acid* : The solution gives a strong reaction.

100 grammes of soil gave 0.02 grammes of iron when treated with the citric solution and 0.06 grammes of iron when treated with the oxalic solution.

Certain silicious soils entirely lacking in lime, as, for example, the soil of Angers, give a fairly large proportion of iron soluble in pure water. In these soils, pink hydrangeas give blue flowers, but, if a small quantity of calcium carbonate or magnesia is mixed with the soil it no longer gives up any iron and the hydrangeas do not become blue. The compounds of soluble iron are, therefore, precipitated by the lime.

A  $\frac{1}{1000}$  solution of ferric chloride was filtered through a layer of soil 20 cm. thick. All the iron was retained in the upper part which turned red-brown. Calcium carbonate precipitates the iron in the form of a basic carbonate which gradually becomes a hydrate. The line of separation is clearly marked, and the filtered liquid contains no iron, but a large proportion of chlorine and calcium. This experiment was repeated with many samples of soil containing different quantities of lime. The coloured layer increases in thickness in proportion as the lime content of the soil decreases. The thickness of the coloured layer does not exceed 2 cm. in soil containing 5 % of calcium carbonate. If ferrous sulphate is used instead of ferric chloride the salt is oxidised and precipitated, and a mixture of basic sulphate and hydrate is formed which colours the superficial layer red-brown, as in the case of ferric chloride.

The results of these experiments show that the iron contained in soils of normal composition is present in a form very difficult to assimilate, which explains the increased yield when very small amounts of soluble iron are added.

The manure can have no favourable effect unless it is placed directly within reach of the roots. This condition is found in pot cultures, or when the manure is added at the beginning of growth, but it is no longer present when the roots have entered the soil to a certain depth, where they receive no trace of the ferric manure, which has been held up and made insoluble in the surface layers of the soil.

Tests were also made with potassium ferrocyanide as a source of iron. The results showed that the compound is not rendered insoluble in the soil, but that certain interesting modifications occur. The salt undergoes a double decomposition, part of the potassium being retained by the soil. When the solution filters through the soil it turns greenish. This is due to the transformation of the ferrocyanide into ferricyanide. This oxidation appears to be due to some surface action, as it also occurs when the solution is filtered through fine sand.

Experiments with potassium ferrocyanide did not give good results as, even in dilute solutions, the salt has a harmful action on vegetation.

406 - **Researches on the Calcium Compounds in Soils in the United States.** — SHOREY, EDMUND, C., FRY, WILLIAM, H., and HAZEN, WILLIAM, in *Journal of Agricultural Research*, Vol. VIII, No. 3, pp. 57-77. Washington D. C., January 15, 1917.

This work was executed by the Bureau of Soils of the United States Department of Agriculture. The present methods of analysis give the composition of a soil by determining the amounts of each of the elements present; it is, however, very important to know, in addition, the form in which they are found combined. The article analysed is a first step in this direction as regards calcium.

The writers examined 63 soil samples representing 23 soil types from 24 localities in 19 States of N. America.

All the samples were analysed chemically and examined petrographically, the results of the two methods of investigation being correlated, as far as possible. The data are given in two series of tables; the results are discussed, and the following summary made :

From the results of the analyses of the 63 soil samples were calculated the amounts present of : calcium carbonate — calcium sulphate — calcium with humus — the calcium in the form of easily decomposable silicates — the calcium in the form of difficultly decomposable silicates. The figures obtained show a wide variation in the total calcium content — in the calcium carbonate and the two classes of silicates. Calcium combined with humus was shown to be absent in 29 samples.

No relation is apparent between the total calcium content and the quantity of any of the classes of calcium compounds discussed.

It is possible to have two soils with the same calcium content, but with the kinds of calcium compounds present in quite different amounts.

Only 5 of the samples, representing 2 types, were acid to litmus. These types are characterised by poor drainage.

A type represented in the series of samples examined, and recognised as a good alfalfa soil, is characterised by a high calcium content, but is low in content of calcium carbonate.

407 - **Drainage by Dynamite in the United States** (1). — *The South American Journal and Brazil and River Plate Mail*, Vol. I,XXXII, No. 9, p. 181. London, February 24, 1917.

An interesting and practical demonstration of the value of dynamite in drainage operations was shown by MR. GRANT KELSEY, a large potato-grower in the United States, at Kiro, Kansas, during the summer of 1915. Fearing that his potato crop would suffer from the excessive amount of surface water due to the persistent rains, especially in a badly drained corner of the field, he determined, as a last resort, to drain off the water by the help of dynamite.

With a post auger, he bored 8 holes at equal intervals through the

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(1) For information on the use of dynamite in preparing ground, see B., 1913, No. 230. (Ed.)



field, ranging from 8 to 12 ft. in depth. In these were placed charges of dynamite carrying from 2 to 5 sticks per hole. The larger charges proved the more effective. Each charge formed channels of varying dimensions, according to the amount of dynamite used, and through these the surface water was rapidly drained into the sandy subsoil. The growing crop had suffered no harm from the stagnant water, and the effect of the drainage lasted through the following spring (1916). The holes formed by the explosions resembled small craters, and the rain water passed through them as readily as through a drain-pipe.

408 - **Irrigation Results Obtained in 1916 at the Horticultural Experiment Station of the Province of Ontario, Canada.**—PALMER, E. F., in *Dominion of Canada, Department of Agriculture, The Agricultural Gazette of Canada*, Vol. 4, No. 2, pp. 125-127. Ottawa, February, 1917.

At the Ontario Horticultural Experiment Station, Vineland, in 1916, increased yields of vegetables and raspberries were secured by the use of the SKINNER irrigation system. The irrigated section comprises slightly over 3 acres. The pipes are 50 ft. apart, they rest on metal supports at a suitable height above the ground, and have nozzles every 4 ft. The water supply is secured from Lake Ontario by a gasoline engine. This system gives entire satisfaction. In 7 hours,  $1\frac{1}{2}$  acres can be watered at a maximum cost of \$ 3.60 per acre, an acre inch of water being supplied.

Much of the value of irrigation depends on the type of soil. A loose, open soil with an open subsoil is the ideal soil for irrigation. A heavy, compact, clay soil will not respond unless cultivation is greatly increased. The soil on the station irrigation block is variable in composition, ranging from a moderate, sandy loam to a heavy clay.

Strawberries and asparagus occupy the lighter soils, raspberries and vegetables the heavier soils.

The whole plot is well manured and cultivated and treated as uniformly as possible, so that the difference due to irrigation will be correctly interpreted.

Water is applied during dry weather, once every week or ten days, about an inch at a time, depending on the rainfall registered since the last irrigation. Calm days are preferred. Bright sunshine while the water is applied does not cause any apparent injury in this district, though dull days or late evening are desirable when applying the water.

*Increased yield per acre due to irrigation :*

Raspberries . . . . .	1136.3	qts.
Asparagus . . . . .	2078	lbs.
Onions . . . . .	77.9	bus.
Beetroots . . . . .	40	bus.
Carrots . . . . .	72.3	bus.

The writer draws attention to the fact that the economic results were highly satisfactory. The amount of water applied during July was 2.9 inches at the cost (at the Experiment Station) of \$ 10.44 per acre. The to-

tal rainfall during this time amounted to 10.1 inches. During a normal, or a drier season, more irrigating would have to be done, but the increased yield would be proportionately higher.

409 - "Matkee" (*Aeschynomene indica* L.), a Green Manuring Plant of Tea Estates in India. — AMOLACK RAM, in *The Agricultural Journal of India*, Vol. XII, Part I, pp. 161-162. Calcutta, January, 1917.

MANURES  
AND MANURING

A common weed found in jungles, tea gardens, and rice fields, etc., locally known at "matkee" (*Aeschynomene indica* L.) has been found to be very useful for green-manuring in the Palampur valley.

It is an annual leguminous weed, having a round stem of erect or creeping habit, stipulate compound leaves attached to the stem with a short stalk; bisexual flowers of yellow colour; the calyx is composed of five sepals, the corolla having five petals; stamens are ten in number.

*Points in favour of the use of "matkee" for green manuring of tea estates.*

a) It is a leguminous plant and will fix nitrogen in the soil; b) it is of rapid growth; c) it checks the growth of other weeds and grasses which hinder the growth of tea bushes; d) it does not in any way hinder the leaf-producing power of the tea plant in its growing season; e) it uses the plant food which is usually washed away during rains and restores it to the field when the crop is ploughed in; f) being a common weed it grows well without any trouble.

Seeds should be sown in the end of May and the crop buried in August, when the plant is in flower.

410 - Plants Used as Green Manure for Tobacco, in Java. — See No. 446 of this *Bulletin*.

411 - "Germaniaphosphat", a New German Phosphatic and Potassic Manure. — BEGER, C. (Hohenheim Experimental Station), in *Fühlings Landwirtschaftliche Zeitung*, Year 66, Part 2, pp. 55-58. Stuttgart, Jan. 15, 1917.

As basic slag and superphosphates are very rare and very expensive in Germany, attempts are being made to replace them by other phosphatic manures, as, for example, "Rhenaniaphosphat" (already described in *B.* 1916, No. 496).

The "GERMANIA" factory of Portland cement at Hanover recently recommended the use of a new phosphatic fertiliser made with German phosphorites from the Lahn district ("Lahn-Phosphorite") and called "Germaniaphosphat".

According to an analysis made by the author, "Germaniaphosphat" contains:

Phosphoric acid	{	total . . . . .	8.7 %
		water soluble . . . . .	0.0 %
		citric acid soluble . . . . .	6.1 %
Potassium . . .	{	total . . . . .	6.3 %
		water soluble . . . . .	5.6 %

The author tested this manure on mustard in pots, taking into consideration only the phosphoric acid and comparing it in 3 different amounts

(0.2 gr — 0.4 gr. — 1 gr. of  $P_2O_5$ ) with manure containing all the chief food materials except phosphoric acid, basic slag, and "Rhenaniaphosphat". He obtained the following results:

Basic slag gave the best results; next came "Germaniaphosphat", then "Rhenaniaphosphat", which only gave yields equal to 38-74 % and 48-83 % respectively of the yield obtained by the use of slag". Germaniaphosphat" is, therefore, slightly superior to "Rhenaniaphosphat".

The author considers "Germaniaphosphat" worthy of use in agriculture, but realises that his manuring experiments only have a limited value and should be repeated.

412 - **The Substitution of Stassfurt Potash Salts by Finely Crushed Austrian Phonolites.** — STOKLASA, JULIUS (Director of the Physiological Chemistry Experiment Station of the Technical School of Prague), in *Österreichisch-ungarische Zeitschrift für Zuckerindustrie und Landwirtschaft*, Year 45, Part 5 and 6, pp. 421-456. Vienna, 1916.

Much has been said in Austria during these last years in favour of phonolite powder as a substitute for Stassfurt Potash Salts. Many factories have supplied crushed phonolite, chiefly as a fertiliser for beet.

TABLE I. — *Average Amounts of Potash found in the Various Potassic Phonolites of Central Bohemia.*

		Origin	Total potash in the dry powder (percentage)	Potash soluble in concentrated HCl (percentage)
I. — Nepheline phonolites	1) Nepheline phonolite	Schäferberg near Ganghof	5.74 %	3.14 %
	2) Nepheline and leucite	Salesl	7.75	3.47
	<i>Idem</i>	Klumpen	6.62	3.25
II. — Nosean phonolites	3) Nosean and nepheline phonolite	Lobosh near Lobositz	8.54	3.18
	4) Nosean and leucite phonolite (hauyne and leucite phonolite)	Kelchberg near Triebtsch	6.54	3.00
	5) Nosean and sanidine phonolite	Bösig near Weisswasser	6.41	2.76
III. — Sanidine phonolites	6) Sanidine and nepheline phonolite	Schreckenstein near Aussig	6.33	2.74
	7) Sanidine and oligoclase phonolite (= Trachyt- phonolith)	Ziegenberg near Wesseln	6.84	2.04
	8) Sanidine phonolite	Klein-Priesen	7.84	1.81
	<i>Idem</i>	Proboscht	7.37	1.58



The potash contained in the phonolitic rocks of Bohemia may be estimated at many hundreds of thousand millions of tons. This phonolite is interesting because, in most cases, the nepheline is replaced by minerals of the sodalite group (usually sodalite, more rarely haityne), and also at times by analcime or natrolite. The substitution of nepheline by fairly large quantities of leucite, which occurs so frequently in the phonolites of the Eifel Mountains has not yet been found in those of the Bohemia "Mittelgebirge".

The following minerals must be considered as potash-containing constituents of these phonolites: — sanidine — anorthose — nepheline — sodalite and haityne — aegirine-augite and aegirine — natrolite and analcime. The most important potassic phonolites of central Bohemia, together with their potash content, are given in Table I.

Nepheline phonolites, nepheline and leucite phonolites, nosean and nepheline phonolites all show a similar action in the presence of concentrated hydrochloric acid. On the other hand, nosean and leucite phonolites yield less potash to this solvent, and nosean and sanidine, sanidine and nepheline, sanidine and oligoclase phonolites, still less. Sanidine phonolites give the lowest yield, nepheline phonolites the highest.

TABLE II. — *Average amount of potash soluble in concentrated hydrochloric acid in the various Bohemian phonolites in relation to the total potash.*

Phonolites	Potash soluble in concentrated HCl; percentage of total potash
Nepheline, nepheline and leucite, nosean and nepheline, nosean and leucite, nosean and sanidine, sanidine and nepheline. . .	37.23—54.70
Sanidine and oligoclase (= "trachytphonolith" = trachytic phonolite) . . . . .	29.82
Klein-Priesen sanidine. . . . .	23.09
Proboscht sanidine. . . . .	21.44
Nepheline. . . . .	54.70

SOLUBILITY OF PHONOLITE POTASH IN A SATURATED SOLUTION OF CARBONIC ACID. — Three different phonolites were carefully crushed. One hundred grammes of each powder were distributed equally among 5 large flasks, into each of which were poured 200 cc. of pure distilled water. Carbon dioxide was passed continuously through the flasks for 72 hours. Finally the amount of potash ( $K_2O$ ) absorbed by the carbon dioxide solution per 100 grammes of phonolite powder was determined. The results are given in Table III.

TABLE III. — *Amount of potash dissolved by the carbon dioxide solution per 100 grammes of the 3 different phonolites.*

Phonolite	Potash dissolved; grammes	Potash dissolved; percentage of the total potash
Lobosh nosean and nepheline. . . . .	0.167	1.80
Bösig nosean and sanidine. . . . .	0.108	1.68
Klein-Priesen sanidine. . . . .	0.061	0.77

Carbon dioxide solution, therefore, dissolves relatively small amounts of potash.

**INFLUENCE OF PHONOLITE ON THE DEVELOPMENT OF SOIL BACTERIA.** Attempts were first made to determine in what way potassic salts used as manure influence the development of bacteria. It was found that, without potash, the growth of *Azotobacter* is inhibited, whereas with potash it increases. Potassium may, therefore, be considered as indispensable to the growth of this organism.

Further experiments were made to determine whether, by bacterial action, the potash of phonolites may become water soluble. Phonolite and kainit were added alternately to the cultures of *Azotobacter chroococcum*. In 480 hours the bacteria had assimilated and transformed into organic matter about 1.7 % of  $K_2O$  in the form of phonolite. In the same length of time the bacteria transformed 8.64 % of the kainit  $K_2O$ .

The following results were obtained from similar experiments with ammonifying bacteria (*Bacillus mycoides*): — in 500 hours the bacteria dissolved and assimilated 5.6 % of finely ground phonolite potash as compared with 13 % of the potash of potassium chloride.

Microscopical examination showed that *Azotobacter* grew badly on the phonolite culture medium, but very well on the kainit medium. There are great variations in the bacterial respiration; in the phonolite medium the bacteria gave out 10.84 grammes of carbon dioxide, in the kainit medium, 27.85 grammes. Kainit, therefore, contributes largely to the development of nitrogen assimilating bacteria. Ammonifying bacteria have a similar action.

**CONCLUSION.** — These experiments show that potassic salts promote the growth and activity of bacteria useful to the soil. In this respect, however, phonolite is much inferior to kainit and potassium chloride.

Experiments were made on the action of phonolite on the quantitative and qualitative yields of sugar beet and barley and the results will be published at a later date.

413 — **The Comparative Action of Ammonium Sulphate, Sodium Nitrate and some Organic Nitrogenous Manures: Pot Manurial Experiments in Russia.** — ЯКУШИНЪ, И. (JAKOUCHKINE, I.), in *Известія Московскаго Сельскохозяйственнаго Института*. (Annals of the Agricultural Institute of Moscow), Year 22, Vol. 1, pp. 137-144, Moscow, 1916.

At the present moment very little is known of the requirements of various plants with regard to any given nitrogenous manure, moreover, during the last few years, many difficulties have arisen in various districts of Russia as the result of using sodium nitrate. These two facts suggested to Prof. PRIANICHNIKOV (Agricultural Institute of Moscow) the following experiments, carried out in 1914.

In damp climates sodium nitrate is easily washed out. In dry climates, on the contrary, it may accumulate on the surface of the soil and thus become injurious. Ammonium sulphate, on the other hand, is less easily washed out and is retained better by the soil. Ammonium sulphate also has other advantages. 1) it has a notable capacity for dissolving, even

in open fields ; 2) its physiological acidity appears to exert a favourable influence even on exhausted soil when exhaustion is the result of an excess of bases ; 3) the cost of ammonium sulphate is so low that the unit of nitrogen in it is cheaper than that of sodium nitrate.

The experiments were made with the following materials : — castor oil cake, horn-scrappings, fish manure, peat-litter manure, sodium nitrate and ammonium sulphate. The soil in the pots was taken from fields belonging to the Agricultural Institute of Moscow and the Agricultural Station of Kiev. Oats, flax and potatoes were the crops studied. Twenty-five parts (0.35 gr.) of nitrogen were added per pot, two parts of phosphoric anhydride and four parts of potassium oxide. Monopotassium phosphate and potassium chloride were used as phosphatic and potassic manures.

Observations on the growth of the plants and their weight led to the following conclusions : —

1) In clay soil ammonium sulphate is preferable to sodium nitrate. This is due to the fact that it not only dissolves the phosphates which are added, but also those which are already in the soil.

2) Horn scrapings and castor-oil cake are about equal in value to sodium nitrate. In this respect it was observed that potatoes grown in pots fertilised with horn-scrappings developed well and became dark green. Madame A. L. MASLOV has shown that, under laboratory conditions, the nitrogen of horn-scrappings becomes available fairly rapidly, more rapidly even than that of powdered dried blood. During 2 months decomposition in pots filled with soil, 20 % of blood nitrogen, 25 % of the nitrogen from horn-scrappings and 52 % of the nitrogen of the castor-oil cake were rendered available. The author considers it highly probable that the action of the horn-scrappings is not limited to the nitrogen, but extends to the sulphur, which the manure contains in large quantities. The excellent results obtained in the experiments on manuring with horn-scrappings carried out by the "Zemstvo" of the Province of Moscow, may be partly attributed to this action.

3) The assimilation of the nitrogen of fish manure (containing an average of 6.01 % of nitrogen and 9.42 % of phosphoric anhydride) did not exceed 40 to 50 % of that of sodium nitrate.

4) Peat-litter manure gives up its nitrogen more easily than manure from ordinary litter.

414 — **The Slow Change of Vine Wood Buried in the Soil.** — PANTANELLI, E., in *Le Stazioni Sperimentali Agrarie Italiane*, Vol. XLIX, Pt. 12, pp. 605-647 + plates VII-X. Modena, 1916.

It is the general opinion that scattered vegetable remains in the soil, especially when wet, are subjected to a rather rapid change which turns them to mould. In the course of research work on bramble-leaf disease of the vine (*Rendiconti dell'Accademia dei Lincei*, (5) XX, 1911, 1st. Half Year, p. 576 — *Stazioni sperimentali agrarie italiane*, XLV, 1912, p. 792) (1), it was seen that fragments of the roots or stems of vines which are bur-

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AND  
PHYSIOLOGY  
OF PLANTS

(1) See also B., 1912, Nos. 572, 969, 1570.

(Ed.).



ied in the soil remain there a long time in the living state. From May, 1911 to October, 1913, the author carried out experiments at the Royal Station of Plant Pathology at Rome on the changes undergone by fragments of vine in soils according to the various degrees of moisture.

Glass cylinders of 5 litre capacity were filled with fine, homogeneous, virgin, sandy loam which had been passed through a 1 mm. sieve. In each cylinder were placed vertically 8 well-wooded cuttings from which the buds had been removed. There were 5 series of 5 cylinders each of which included: 2 cylinders with unsterilised soil; 2 with earth sterilised by  $\frac{5}{1000}$  phenol; 1 flask with earth sterilised by being heated 3 times for 1 hour in the autoclave at 134° C. In these cylinders were placed respectively: 1) unsterilised cuttings; 2) cuttings sterilised for  $\frac{1}{2}$  hour at 134°; 3) unsterilised cuttings; 4) cuttings pasteurised for 30 minutes at 55°; 5) cuttings sterilised for 1 hour at 134° on 3 different days. Twenty per cent of sterilised water was added to the last series. For each series experiments were made under the following degrees of moisture: — 35 % — 20 % — 5 % — Microscopical and chemical examinations were made of each series after 7 months, 15 months and 2  $\frac{1}{2}$  years. The chemical examination included the estimation of the total nitrogen, protein, assimilable carbohydrates, ash and phosphoric acid. The results are summarised as follows: —

1) Stress should be laid on the great vitality of vine-cuttings which have been stripped of their buds and buried. The wood of all the vines tested remained alive for about 15 months. The wood which showed the greatest resistance to *post mortem* decomposition was that of *Rupestris*, that of *Riparia* and of *Riparia*  $\times$  *Berlandieri* came next; that of *Vinifera* was the least resistant.

2) During the first 15 months the alterations caused were due essentially to the activity of the tissues. The following changes were observed: — solution of the starch, auto-digestion of the plasmatic proteins, formation of tannic-albumin clots, condensation of gum-resin insoluble in water. The changes themselves consisted of: —

a) *humification*; concerning only the protoplasm and connected with the respiratory activity. It is an enzymatic oxidation of the decomposition products of the albuminoids, probably of the nucleo-proteins, with formation of *melanins*. Autogenous humification is, therefore, greater and more rapid in the tissues of the bark which are rich in plasma, and in the cambium;

b) *maceration* (solution of the peptones of the intercellular layer), most rapid in the parenchyma. It particularly attacks the cambium, loosening the bark, which also undergoes rapid disintegration on its inner side. On the other hand, in the wood bundles, maceration progresses slowly, starting from the circumference.

Aeration favours humification. Maceration, solution of the starch, and autodigestion of the protoplasm are more marked in very damp soil. Oxidation, which is followed by humification, preserves the plasmatic

proteins from an ulterior digestion. Aeration also encourages the precipitation of the albumin by tannin, and gummosis.

There are, thus, two types of alteration according to whether the soil is very dry or very damp. In the first case there is a strong autodigestion of the contents and maceration, slight humification and gummosis. In the second case there is masked humification of the contents and formation of gum, and slight autodigestion and maceration. All these autolytic processes continue after the death of the tissue.

3) The invasion of micro-organisms, particularly that of fungi, hastens these phenomena, especially maceration of the tissues rich in plasma and humification within the wood.

4) Pasteurisation does not prevent humification. Pasteurised wood macerates with difficulty, but pasteurised bark humifies and macerates more rapidly than living bark. In very damp earth the pasteurised cuttings were attacked by fungi as much as were live cuttings, and, in dry earth, to a greater extent. Sterilisation in the autoclave prevents autogenous alteration, but does not weaken the resistance of the wood to attacks by fungi, indeed, it seems to make it more resistant.

5) No bacteria were observed among the micro-organisms in the wood, but myxomycetes, actinomycetes and eumycetes were frequently found. The two former only attacked dead wood. The eumycetes alone acted as agents in the decomposition of the wood; live wood was attacked by some of them, including *Phoma vitis*, *Speira densa*, *Torula moniloides* and an *Acremonium*.

Between the autogenous alteration of the wood and that produced by fungi were quantitative differences in humification and maceration, and qualitative differences where the fungi had eliminated the lignin and dissolved the cellulose.

The tannic-albumin and the gum-resin were not attacked by fungi; in fact, humification had a preserving effect.

6) The total organic nitrogen decreased in the absence of fungi, it increased in the wood attacked by these micro-organisms. The protein nitrogen increased only in the wood attacked by fungi. In other words, buried wood, when invaded by fungi, became richer in mycoprotein. Loss of the soluble nitrogen always occurs, even in immune wood, and autodigestion of the protein takes place in both live and pasteurised wood.

7) The soluble assimilable carbohydrates diminished greatly even in the absence of fungi. The insoluble assimilable carbohydrates decreased in proportion as the fungi invaded the wood. In damp soil they increased, perhaps as a result of a partial hydrolysis of the cellulose. The digestion of the carbohydrates varied with the aqueous character of the tissues. In very moist soil the starch was dissolved and loss of the sugar occurred. In dry soil there was formation of gum and destruction of the hemicelluloses. In well aerated soils the cellulose was only attacked by wood-destroying fungi, never by autodigestion.

8) In wood which was not attacked by fungi the mineral constituents diminished as a result of leaching; the increase observed in the



wood which had been attacked was in correlation with the loss of organic matter. The phosphoric acid decreased in proportion as the wood was invaded, that is to say, the phosphoric compounds were eliminated by the mycelium. As a result of autolytic processes there was a decrease of phosphoric acid, even in the absence of fungi. This loss shows that auto-digestion of the albumins and other organic phosphoric compounds progresses greatly in the first 15 months. If, during the autolysis of these materials, compounds are formed which are harmful to higher plants, it is possible that vine wood which has been buried in the soil for two years may poison the surrounding land to a marked degree.

415 — **The Action of Bacteria and Fungi in the Tissues of Plants.** — BERTHOLD, ERICH, in the *Jahrbuch der wissenschaftliche Botanik*, Year 57, Pt. 3, pp. 387-458, Leipzig, 1917.

Three groups of experiments were carried out with a view to elucidating the vital relationship between plants and bacteria ;

1) Experiments on the sterility of the tissues of herbaceous plants, the sap and the heart-wood of woody plants.

2) The determination of the depth to which bacteria and fungus spores penetrate into the branches of woody plants in the water absorbed by their sections.

3) The injection of various bacteria into the tissues of herbaceous and woody plants and the determination of their longevity.

Bacteria were also placed in contact with isolated and living vegetable tissues, so that their action on living tissues, as well as on tissues treated with an alkali or an acid could be observed.

RESULTS : — 1) The normal tissues of herbaceous plants were found to be free from bacteria ; the sap and heart-wood of fibrous plants were also sterile. 2) When wood was attacked by fungi their presence could be ascertained, but not that of bacteria. It may be assumed that bacteria do not enter the wood with the mycelium of the fungi, and that bacteria cannot grow in wood attacked by fungi.

3) Bacteria and fungus spores are introduced through the vessels in the water absorbed by a section. Micro-organisms, therefore, penetrate in fairly large numbers into the branches of woody plants having long vessels, whereas bacteria were only observed on the proportionately shorter spaces in the wood whose vascular tissues have short tracheides.

4) The liquid containing bacteria and fungus spores filtered entirely through the lateral non-perforated walls of the tracheides (walls which determine the length of the latter), whereas a certain filtration took place during the passage through the unbroken parts of the vessels.

5) Bacteria injected into both live herbaceous tissues and live wood, remained alive for a considerable time, in one case for more than 10 months.

6) The saprophytic life of bacteria introduced into wood was not seen to extend in any way.

7) The longevity of the bacteria may be explained by their strong resistance to exterior unfavourable conditions. Nothing was observed which would permit the assumption that the living tissues exert any action against the bacteria.



8) Although they did not die, no obvious external sign of the development of the bacteria was noticed in the isolated live plant tissues. This does not seem due to the acidity of the tissue, because, even after treatment with acid which caused the tissues to decay, they were, nevertheless, still capable of serving as a nutritive medium.

9) It appears that the tissue must be dead before its nutritive substances can be utilised by bacteria.

416 - **A Saponin from *Yucca filamentosa*.** — CHERNOFF, I. H., VIEHÖEVER, ARNO, and JOHNS CARL, O., in *The Journal of Biological Chemistry*, Vol. XXVIII, No. 2, pp. 437-443, Baltimore, Md., January, 1917.

This work was carried out at the Bureau of Chemistry, United States Department of Agriculture, Washington.

The presence of a saponin in *Yucca filamentosa* was first reported by MORRIS in 1895; SCHULZ and MEYER had obtained, in 1896, a saponin which was insoluble in water, but they did not determine its molecular weight.

The writers obtained from the dried root stock, about 6 per cent of crude saponin,  $C_{24}H_{40}O_{14}$ ; its properties are different from those of the saponin previously extracted. It is soluble in water, alcohol, phenol and glacial acetic acid, and cannot be precipitated from the aqueous solution by neutral lead acetate, basic lead acetate and barium hydroxide. No cholesterol compound could be prepared. Haemolysis was observed after 15 minutes in the saponin solution (1 to 20 000) containing rabbit blood and kept at 37° C. The surface tension at 37°C. was 56.69 dynes per sq. cm.

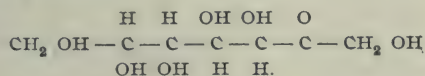
Hydrolysis of this saponin yielded a sapogenin, with no hemolytic action, a glucose, and also glucuronic acid.

The saponin is located as brownish amorphous masses in the fibrovascular bundles of the roots and leaf bases.

417 - **A New Sugar Extracted from the Fruit of the Avocado (*Persea gratissima*).** — I. LA FORGE, F. B., D. Mannoketoheptose, a New Sugar from the Avocado, in *The Journal of Biological Chemistry*, Vol. XXVIII, No. 2, pp. 511-522. Baltimore, Md., January 1917. — II. WRIGHT, F. E., Crystallographic and Optic Properties of Mannoketoheptose and of the Osazones of Mannoketoheptose and Mannaldoheptose, *Ibid.*, pp. 523-526, 2 fig.

I. — This work was done at the Carbohydrate Laboratory, Bureau of Chemistry, United States Department of Agriculture, Washington.

The writers isolated from the fruit of the avocado a new sugar which exists there in the free state. This fact is noteworthy, because there is thus added another monosaccharose to the small number of such substances found in a free state in nature, and of which only two, glucose and fructose, are widely distributed in any considerable quantity. The new sugar is both a ketose and a heptose, and is accordingly the 4th. natural ketose to be isolated, (the other 3 being fructose, sorbose and ketoxylose). The writer has given this new sugar the name of d-mannoketoheptose and has shown that it has the configuration :



From 3 500 gm. of pulp 50 g. of sugar were obtained.

In 1888, from the fruit of the avocado, *d*-perseite was extracted, a heptahydroxy alcohol which can also be obtained by the reduction of  $\alpha$ -mannoheptose. The occurrence in the same fruit of these two similar and rare seven-carbon members of the sugar group suggests that there may be some biological relationship between them, and this view receives support from the fact that the new heptose can be transformed into *d*-perseite by reduction with sodium amalgam.

II. — Researches carried out at the Geophysical Laboratory, Washington. D-mannoketoheptose forms tabular crystals belonging to the monoclinic system, they are sphenoidal, and transparent, pale yellow in colour, and about 2 mm. in diameter.

418 — **The Part Played by Oxidases in the Improvement of Cultivated Plants; Biological Experiments and Considerations.** — DEGLI ATTI, M., in *Annali della R. Scuola Superiore di Agricoltura di Portici*, Vol. XIV (Reprint), Portici, 1917.

The author points out that, since the discovery of *laccase* (1883), the relationship of the oxidising ferments to cultivated plants has been studied only by Prof. COMES. In 1909 Prof. COMES showed, for the first time, the importance of these ferments in the improvement of plants and their destruction of the acids of the organic juices (1). The author then summarises the principal results of his investigations:

On studying the distribution of oxidases in the organs of *Sambucus nigra* (wild elder) they were found concentrated to a marked degree in both the radical and cauline seats of neoformation. This shows the importance of oxidases in the neoformation process of the tissues. A kind of oxidasic exudate was also observed in the external parts of the extremities of the rootlets (evidently connected with the absorption functions).

Similar observations were made in the case of different varieties of Japanese medlar (*Eriobotrya japonica*). The improved variety with a longer biological cycle, whose fruit is longer, bigger, sweeter and less acid, is, all other conditions being equal, richer in oxidases than the less cultivated variety whose biological cycle is shorter, and whose fruit is round, small, less sugared and more acid.

This inverse relationship between the average amount of acidity and oxidases, and the direct relationship between the average amount of sugars and oxidases, shows up more strikingly in a comparative analysis of 3 citrus varieties, lemon, orange and mandarin. The absence of oxidising zymases in the vegetative organs of the lemon tree and their gradual disappearance from its fruit, leads to the assumption that there exists a certain incompatibility between zymotic activity and a strong excess of acid.

Analytical investigations of many varieties of European vine (high trained or low trained) and American vine (pure or hybrid) confirmed this assumption. It was seen that the amount of oxidases present increases in proportion as the vines are improved, that is to say, have a longer

(1) Cf. COMES, Del fagiuolo comune (On the Common Bean) in the *Atti del R. Istituto d'Incoraggiamento*, Naples, 1909.



biological cycle, shorter internodes, smaller foliary sinus, sweeter and less acid fruit. The above-mentioned phenomena occur also in these plants. The superficial roots contain more oxidases than the deep roots, consequently vines with deep roots (high trained vines on trellises, arches, etc), and with a relatively small geotropic angle (less-improved European vines or pure or hybrid American vines) contain insufficient oxidases in the roots. This is followed by an insufficient amount in the aerial organs, with all the results this entails — higher acidity and too little sugar.

These facts are brought still more into evidence by a comparative study of various common fruits, such as Japanese medlars, peaches, apricots, cherries, tomatoes, sorb-apples and common medlars. In each case the correlations already described are found in the reproductive organs.

Continual changes in the migration of the oxidising ferments occur during the physiological ripening of the fruit. In the first stage (that of growth) the zymotic substance is attracted to the fruit from the branch next to it, so that this substance accumulates within the ducts of either the placenta or the peduncle, whilst the sugars of the surrounding parenchyma remain acid. In the following stage (that of ripening), on the contrary, the oxidases leave the ducts, filter through the cells of the parenchyma and mix with the juices, which then gradually begin to lose their acidity. The decrease in acidity is slow in fruit which is still on the plant; on the other hand, in plucked fruit, it is exceedingly rapid.

The obvious coincidence of these facts which are certainly not related as cause and effect, points to the supposition that the two phenomena are intimately connected, so much so that, in one species, it is precisely the improved varieties, those containing the most oxidases, which lose their acidity most easily and to the greatest extent. Moreover, when sorb-apples and common medlars become over-ripe, a great part of their acidity disappears at the same moment as the oxidases leave the ducts. This last phenomenon, accompanied by the loss of acidity, may proceed in a *centripetal* direction, i. e., from the external layers to the internal layers (as in sorb apples), or in a *centrifugal* direction (as in common medlars, sleepy pears and apples).

On the other hand there is no relationship between the breaking-down of the organic acid molecules by the oxidases and the increase of sugars in the fruits. Everything points to the conclusion that oxidasic combustion causes a greater simplification of the molecules themselves, and, directly, their reduction to inorganic compounds (carbonic acid and water). It is, however, probable that direct sunlight, with or without the intervention of zymases, may convert the organic acids to sugar.

All the results obtained emphasise the importance of oxidases with regard to the biology of cultivated plants and lead to the conclusion that the accumulation of oxidases is intimately connected with all cultural evolution. It is certain that those plants which have been carefully and intensively cultivated for a long time, contain more oxidases than plants of the same species which have been less highly cultivated or are wild. This proves that the zymogenic substance has its origin in cultivation, which,



in the course of many centuries, determines the main characteristics which distinguish those varieties of one species which have been improved and brought to diverse degrees of perfection.

In all districts cultivation has always consisted chiefly in manuring (with dung), irrigation and digging. The genetic connection between the nitrogen in manure and the zymogenic substance, which had already been pointed out by Prof. COMES, is thus brought very clearly into evidence.

From this substance, as yet very undefined, are derived two types of soluble ferments — hydrolysing and oxidising. The former mobilise the reserve substances, thus preparing a material more easily utilised by parasites (sugar and soluble nitrogenous substances). The latter attack and break down more particularly the acids (which make the food unpleasant) thus rendering more conspicuous the above-mentioned chemiotropical substances which are most abundant in cultivated plants (1).

It is thus seen that the action of zymotic ferments, which accumulate particularly in the tissues of highly cultivated plants, causes a series of biochemical phenomena which includes scission — grouping — breaking-up of molecules — etc.

419- **The Cryoscopic Constants of Expressed Vegetable Saps as Related to the Local Environmental Conditions in the Arizona Deserts** (1). — HARRIS, J. ARTHUR, and LAWRENCE, JOHN, V., with the cooperation of GORTNER ROSS, AIKEN, in *Physiological Researches*, Vol. 2, No. 1, pp. 1-49. Baltimore, Maryland, July 1916.

The many experimental data hitherto obtained exclusively in the laboratory have proved that the physico-chemical properties of the cell sap of different plants are in a large degree dependent upon the environmental conditions to which they are exposed, and change when these are altered. These conditions are: temperature, humidity of the air, light intensity, etc. It does not seem to have occurred to the plant physiologists, or the ecologists, that the results of attempts to modify the properties of the cell sap by controlling and varying conditions should also be tested out in the field. If variations in the properties of the cell sap comparable to those which may be induced in the laboratory are not to be found in nature as a result of environmental conditions, laboratory experimentation would probably lose much of its significance in plant physiology. If such variations, however, do occur in nature, they are of fundamental importance to the ecologist, phytogeographer, and evolutionist. The writers have undertaken the study of this problem, and they give the results they obtained by examining the concentration of the cell sap of various plants growing under very different conditions. This concentration, which is proportional to the freezing point lowering, can be deduced directly from the latter with the assistance of the tables *ad hoc* drawn up by HARRIS and GORTNER.

The writers proceeded as follows: the cell sap was expressed by means

(1) Cf. COMES, I, a profilassi nella Patologia vegetale (Prophylaxis in Vegetable Pathology), in *Atti del R. Istituto d'Incoraggiamento*, Naples, 1916. — This paper is summarised in *B.* 1916, No. 937.

of a large screw-press and then centrifuged to clear it as much as possible. The results were expressed in freezing point lowering in degrees ( $\Delta$ ) by means of the usual Beckmann's thermometer which is subdivided into thousandths of a degree centigrade and provided with a very simple apparatus for the evaporation of ether. The osmotic concentration (pressures) is given in atmospheres (P). The plants examined belong to 4 groups: 1) Trees and shrubs; 2) Half-shrubs; 3) Herbaceous perennials; 4) Herbaceous annuals.

The region selected for the observations is that surrounding the Desert Laboratory in Tucson, Arizona, and is very suitable for the purpose, as within a comparatively limited area, it affords the 5 following local environments:

1) *The Foot-hill Canyons*. — Pima canyon, where the writer's collections were made, is a narrow valley with precipitous slopes and running N. E. - S. W. In spring, thanks to its sunny exposure, its vegetation is more advanced than that of other localities of the same elevation. The transient stream that flows during the spring months along the bottom of the valley, disappears as a surface feature as the season advances, but it is quite possible that during most of the year, the ligneous plants are able to draw upon an ample water supply, while their aerial portions are exposed to an atmosphere of high evaporating power and intense insolation.

2) *Cliffs, or ledges, and steeper rocky slopes*. — Here there are masses of loose rock cemented by a compact and impermeable soil which retains large quantities of water. The moisture and shade in the crevices between the blocks create persistent mesophytic conditions.

3) *Bajadas, or Mesa-like slopes*. — These are more gently sloping masses of detrital materials which form slightly inclined terraces. For a depth of 20 cm., the soil is in many places air-dry during most of the year. The brevity of the period during which the soil contains sufficient water for plant growth is one of the factors that contribute to give the flora a distinct xerophytic character, those species being predominant which are furnished with a water storage system, or very deeply penetrating roots.

4) *The arroyo or wash*. — The channels, for the most part dry, of the water courses traversing the "mesa". The coarse sand and gravel, although very permeable, afford better conditions for plant growth than the surrounding "mesa", as is shown by the number of herbaceous annuals growing in spring in the most protected parts.

5) *Salt spots*: In these, there is a pronounced accumulation of alkaline salts. The Flora is halophytic (*Chenopodiaceae*).

The osmotic concentration of the cell sap varies considerably according to the different habitats, as is seen in Table I which gives the comparison of averages of the osmotic concentrations, the value for the "arroyo" being taken as unity.

The lowest osmotic concentrations are thus found in the plants growing in the arroyo, while the highest occur in those from the salt spots. To complete the data set forth in Table I, Table II shows the values of  $\Delta$  (the

TABLE I. — Comparisons of averages of osmotic concentrations of the cell sap in the different groups of plants from the different habitats; the value for the arroyo is taken as unity.

Growth Form	Arroyo	Canyons	Rocky slopes	"Mesa"	Salt spots	All habitats
Trees and shrubs . . . . .	1.00	1.27	1.26	1.96	2.71	1.59
Dwarf and halfshrubs . . . . .	1.00	1.17	1.32	1.41	2.06	1.69
Perennial herbs . . . . .	1.00	1.02	1.25	1.45	1.82	1.20
Winter annuals . . . . .	1.00	1.00	1.18	1.64	—	1.14
All species . . . . .	1.00	1.25	1.34	1.90	2.67	2.39

TABLE II. — Values of  $\Delta$  and  $P$  in certain plants which are capable of growing in 2 or 3 different habitats.

Plants	"Arroyo"		Pima canyon		Rocky slopes		"Mesa"		Salt spots	
	Val- ues of $\Delta$	Val- ues of $P$	Val- ues of $\Delta$	Val- ues of $P$	Val- ues of $\Delta$	Val- ues of $P$	Val- ues of $\Delta$	Val- ues of $P$	Val- ues of $\Delta$	Val- ues of $P$
<i>Hyptis emoryi</i> Torr. . . . .	—	—	0.96	11.6	1.13	13.6	—	—	—	—
<i>Lippia Wrightii</i> A. Gray . .	1.26	15.1	—	—	1.43	17.1	—	—	—	—
<i>Yucca macrocarpa</i> Torre En- gelmann . . . . .	1.53	18.4	—	—	1.62	19.5	—	—	—	—
<i>Psilostrophe Cooperi</i> (A. Gray) Greene . . . . .	1.78	21.3	—	—	—	—	1.90	22.9	—	—
<i>Eschscholzia mexicana</i> Greene	0.99	11.9	—	—	1.27	14.7	1.92	23.0	—	—
<i>Nemoseris neo-mexicana</i> (A. Gray) Greene. . . . .	0.74	8.9	—	—	—	—	1.17	14.1	—	—
<i>Streptanthus arizonicus</i> S. Wats	1.17	14.1	—	—	1.60	19.2	1.61	19.4	—	—
<i>Atriplex canescens</i> (Pursh) James. . . . .	—	—	—	—	—	—	4.08	48.8	5.65	67.5
<i>Calycoseris Wrightii</i> A. Gray.	0.97	11.6	—	—	1.12	13.5	—	—	—	—
<i>Astragalus Nuttallianus</i> D. C. Var . . . . .	1.34	16.1	—	—	1.69	20.3	—	—	—	—

freezing point lowering) and of  $P$  (osmotic concentration) in some plants which are able to grow in 2 or 3 different habitats.

On comparing the results obtained at Tucson with other data (as yet unpublished); for Long Island — Jamaica mangrove swamps — coastal deserts — mountain rain forests — and for a series of habitats in subtropical Florida — we are led to the conclusion that the study of the physico-



chemical properties is as important a part of ecological and phytological investigations as the description of the external morphology and internal structure of the species of a flora.

The cell sap is the product and the environment of all the activities of the protoplast, therefore its chemical and physical properties should be factors of fundamental importance in plant physiology. Hence it is reasonable to suppose that the differentiation of plants growing in different habitats is due partly to specific variations in the osmotic concentration of the cell sap in the several species, and partly to the direct influence of external agents on the composition of the cell sap in different individuals.

420 -- **New Practical and Scientific Experiments in the Selection of German Wheats Rich in Gluten.** — VON CARON-ELDINGEN, in *Deutsche Landwirtschaftliche Presse*, Year 43, No. 14, pp. 112-114. Berlin, 1916.

PLANT  
BREEDING

Since the importation of foreign wheat has stopped, German wheat bread has become more and more defective; it is hard, thick, indigestible and unpleasant to the taste. This, according to the writer, is due to the poor bread-making properties which characterise German wheats. As long as wheat could be imported from abroad German agriculturists felt little impulse to obtain varieties of good quality. Preference was given to English Squarehead wheats because of their high yield. As these varieties were not sufficiently resistant to German winters they were crossed with others. Though the wheats thus obtained were stronger and more productive, their bread-making qualities were not improved.

It is well known that the bread-making quality of wheat is closely related with the nature of its gluten and its ash content. Chemical analysis of gluten has hitherto given no data on which to base valuation, whereas investigations into its physical properties have given important results. An elastic, tough, dry gluten is good for bread-making, a soft, damp gluten of great extensibility, on the other hand, bakes badly. The higher the ash content of the flour, the less easily does it bake. The bread-making capacity of wheat is shown, and judged, by the volume of bread after baking. All these characteristics must be considered if good varieties of wheat suitable for bread-making are to be obtained by selection.

Recently there has been a tendency to distinguish two types of inheritance in the vegetable world: — 1) the so-called "external" inheritance, which affects the morphological properties, is known up to a certain point (mendelism); 2) the so-called "internal" inheritance which has not yet been scientifically explained, and which affects the physiological properties; — "values", "factors" or "gens". The author is convinced by the results of crossings with wheat which he made, that the internal properties of an individual are transmitted by the dissociation of the "gens". In inheritance these are split up into positive "gens" and negative "gens" and unite with the positive and negative "gens" of the other individual to form new "gens". The accumulation of similar "gens" in this type of crossing depends on the abundance of "gens" of the other individual used in the crossing.

In practical selection, therefore, the first consideration should be an

exact analysis of the genitors, their content in moist gluten and ash as well as the quality of the gluten.

All German wheats either directly or indirectly descended from English Squarehead, should be eliminated, not only because they are poor in gluten, but also because the quality of their gluten does not meet German requirements. The gluten of English wheats is soft, moist, of great extensibility and lacking in tenacity; it is, therefore, not adapted to the purpose proposed.

Once the required internal properties have been found, the morphological properties of the genitors must be examined. The most important factor from this point of view is the capacity of giving a high yield. Experiments carried out at Eldingen and Weihestephan show that this capacity is quite reconcilable with a high gluten content.

When the best parents have been chosen, both from a morphological and physical point of view, the practical work may begin. The desired end will only be reached if reciprocal crossings are effected and if the two new subjects show the same inheritance of internal physiological properties. It is difficult to give figures illustrating the result obtained; the best criterion is the practical yield in bread-making. This should be scientifically established in an unmistakable manner.

Up to the present there is only one variety of wheat in Germany which possesses to some degree the qualities described, this is the 'Eldinger Kleberweizen', or Eldingen wheat, rich in gluten, which has been selected in that district.

421 - **The Selection of Native Wheat in Hungary and Barley in Sweden; The Function of the Awns and Their Correlations with Other Characters.** — See No. 430 of this Bulletin.

422 - **Improvement of Black Oats by Selection and Crossing in Sweden.** — NILSSON-EHLE H., in *Sveriges Utsädeförenings Tidskrift*, Year XXVI, No. 6, pp. 219-231, 2 fig. Malmö, 1916.

This paper gives the results of a series of experiments on selection and hybridisation carried out at Svalöf from 1901-1917 in order to improve black oats in Central Sweden. The experiments may be divided into 3 parts: —

1) Attempts were made to see to what extent it is possible to improve directly, that is to say, without the introduction of foreign elements, types of native oats which are distinguished by their earliness and adaptability to very unfavourable soil and climatic conditions. *Fyrishajre* (Fyris oat) may be cited as an example resulting from the first individual and aggregate selection experiments. Whilst still retaining their characteristics of adaptability and precocity, this variety surpasses the common ones in average yield of grain.

2) The native varieties, whether common or selected, always have a weak culm, and are, therefore, subject to lodging. They cannot, for this reason, be sown in light, friable and fertile soils where the rapid and considerable growth of the straw would further decrease its elasticity and



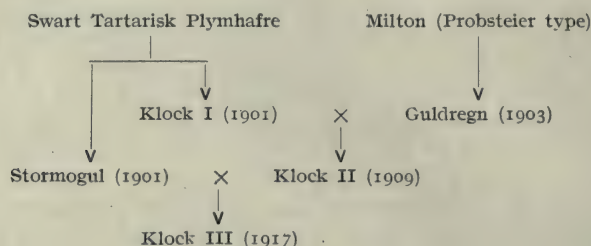
resistance. In this case use must be made of other types of black Tartar oats ("Svart Tartarish Plymhafre") with elastic and resistant culms, oats which were introduced to counteract these disadvantages, and which, little by little, have been mixed and crossed with the native types. A multiform biological whole has thus been formed which is well adapted to selection and the isolation of the best types. In this, way two well-known varieties have been obtained at Svalöf: — "Klock I" and "Stormogul", which unite in one type the productivity of native oats and the strong straw of tartar oats. "Klock I" is, moreover, remarkable for its earliness. These two new types have been successfully introduced amongst the black oats in districts where, for the reasons given above, the soil is too fertile and too rich to permit of the use of native types.

3) The third set of experiments aimed at the progressive improvement (increase in production) of black oats by hybridisation with types of white oats having a high yield. The first tangible result was "Klock II" ("Klock I"  $\times$  "Guldregn") which, in productivity and the quality of its grain (see Tables I and II), is much superior to "Klock I" whilst still retaining intact its resistance and the strength of its culms. These are, doubtless, excellent and practical results, but the activities of the Svalöf Station go yet further. "Stormogul" is a variety valuable on account of its high yield of both straw and grain, but it ripens late and is thus restricted to certain districts. By crossing "Stormogul" with "Klock II" the characteristics of these two varieties have been united in one type. From amongst the descendants various lines have been isolated, the last of which is the line OII43, known as "Klock III". The great success of this crossing, apart from the *earliness* of the one and *higher yield* of the other, is due to the fact that both varieties are very similar in all other characteristics. From the 2nd. generation ( $F_2$ ...  $F_n$ ) on, numerous variations and divergences in the characteristics have been observed which have made it very difficult to fix the new hybrid. It has also not been found possible to render stable, in one individual, both precocity and a high yield in straw. For this reason the results obtained have a peculiar meaning and significance. "Klock III", though as early as "Klock II", gives a higher yield in grain than "Stormogul" (see Table III). Cultural experiments carried out in the black oat zone (Östergötland, Örebro, Stockholm, Upsal and Västmanland), fully confirm the results previously obtained at Svalöf (see Table IV). From numerous tests it may be assumed that "Klock III" is as early and has as resistant a culm as "Klock II", whilst showing a greater productivity, inherited from "Stormogul". It may be seen from the following diagram that "Klock III" is inferior to "Stormogul" only in yield of straw.

	Klock II	Klock III	Stormogul
Earliness. . . . .	+	+	—
Yield in grain . . . . .	—	(+)	+
Yield in straw . . . . .	—	—	+



Below is the pedigree of the new variety : —



Since 1901 the "Sveriges Utsädeförening" (Swedish Society for Seed Production) placed on the market the following new varieties of black oats : — Klock I (1901) — Stormogul (1901) — Klock II (1909) — Fyris (1911) — Klock III (1917). "Fyris" gives excellent results in compact clay soils, and attempts have been made to improve it still further by crossing it with "Klock II". Thanks to their earliness and the resistance of their culms, the "Klock" types have spread rapidly, replacing the Tartar oats originally cultivated. It is highly probable that the experiments, in view or now being actually carried out, on new hybridisations of "Klock III" with "Stormogul", and of "Klock II" and "Klock III" with "Guldregn" (or other productive white oats), will still further increase the yield of black oats. There is nothing to prove that "Klock III" really represents the *best* result that can be obtained by combining "Klock II" with "Stormogul". As a rule, productivity is determined by so many factors that they are rarely transmitted all together by the parent plant to its descendants. Further crossing may, therefore, increase the number of these factors in the hybrid and thus augment its yield.

TABLE I. — *Results of Comparative Cultural Experiments with the Oat Varieties "Klock I" and "Klock II" carried out at Ultana from 1904 to 1912.*

	Yield in grain		Quality of grain			
	Kilograms per hectare	Relative Index	Percentage of grains	Weight of 1 hectolitre	Weight of 1000 grains	Grains germinated
Klock II . . . . .	2 422 kg	105.8	67.96 %	46.12 kg	28.35 g	1.57
Klock I . . . . .	2 289 kg	100.0	66.33 %	45.86 kg	27.56 g	1.95

TABLE II. — *Comparative Cultural Experiments on "Klock I" and "Klock II". Average Results for 63 Districts of Central Sweden (1905-1909).*

	Yield in Grain		Quality of grain			
	Kilograms per hectare	Relative Index	Percentage of grains	Weight of 1 hectolitre	Weight of 1000 grains	Grains germinated
Klock II . . . . .	2 704 kg.	106.1	69.34 %	47.8 kg.	28.80 gr.	1.26
Klock I . . . . .	2 549 kg.	100.0	68.40 %	46.6 kg.	28.19 gr.	1.79

TABLE III. — *Results of Comparative Cultural Experiments of the Varieties "Klock II", "Klock III" and "Stormogul" at Svalöf from 1912 to 1916.*

	Yield per hectare						Relative Index Klock II = 100
	1912	1913	1914	1915	1916	Averages	
	kg	kg	kg	kg	kg	kg	
<i>Grain :</i>							
Klock III . . . . .	3 780	4 170	2 560	3 010	4 580	3 620	109.9
Stormogul . . . . .	3 860	4 160	2 700	3 030	4 160	3 582	108.7
Klock II . . . . .	3 730	3 870	2 360	2 280	4 230	3 284	100.0
<i>Straw :</i>							
Klock III . . . . .	5 060	4 530	2 470	3 825	7 850	4 747	100.3
Stormogul . . . . .	5 810	5 330	2 850	4 550	7 630	5 234	110.6
Klock II . . . . .	5 260	4 470	2 310	4 300	7 330	4 734	100.0

TABLE IV. — *Results of Comparative Cultural Experiments with "Klock III" and other Oats, Carried out from 1914 to 1916 in the Districts of Östergötland, Örebro, Stockholm, Upsal and Västmanland.*

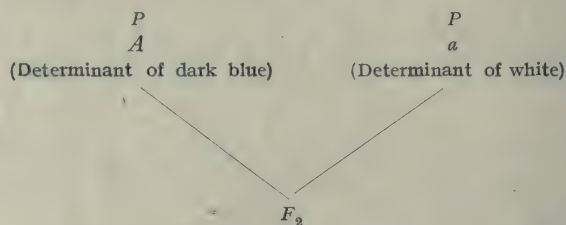
	Yield in grain per hectare (Average of all the experiments)	Relative index (Klock II = 100)
01 143 Klock III . . . . .	2 399	109.2
0 450 Stormogul . . . . .	2 387	108.6
0 408 Klock II . . . . .	2 197	100.0
01 004 Fyris . . . . .	2 192	100.4
Roslag . . . . .	2 283	95.8
Black Tartar . . . . .	1 832	83.5

423 - The Composition of Hybrids of *Zea Mays* L. as Regards the Structure of the Endosperm. — KENJIRO I'UJII and YOSHINARI KUWADA, in *The Botanical Magazine*, Vol. XXX, No. 351, pp. 83-88. Tokyo, March 1916.

The manifestation of a character depends upon the presence of *determinants*, fundamental, indivisible, biological unities which are transmitted integrally. Each character depends either upon one, or upon several, determinants; *vice-versa*, one determinant may influence several characters. Hence the importance of investigations undertaken for the purpose of discovering the nature and number of these determinants, or *genes*, which by their different modes of segregation, or of splitting up, according to the laws discovered by MENDEL, enable the biologist to draw up biotypic formulae of the different varieties and to modify them subsequently in the desired direction by means of selection and hybridisation, suppressing the undesirable characters and replacing them by desirable ones.

In *Zea Mays* (as in most Angiosperms), the endosperm-tissue is formed by the further divisions of the primary endosperm cell, whose nucleus is the product of the union of the 2 polar (female) nuclei of the embryo-sac and one of the 2 male nuclei from the pollen tube. Every character of the triploid endosperm is thus dependent upon 1 male and 2 female determinants. Still, so far, this cytologically well-established fact has not been accounted for in the construction of the heredity-formula of maize. Owing to this fact, the actual results of crossing 2 different strains of maize are, as far as the character of the endosperm is concerned, widely different from what is theoretically to be expected.

This is exactly what happens on crossing certain strains bearing white or black seeds with other strains producing white seeds. When the *maternal* parent bears black seeds, and the *paternal* parent white, the colour of the seed in the hybrids of the 1<sup>st</sup>. generation is much darker than in the inverse cross where the *maternal* parent has white seed and the *paternal* black. The zygotic formula for endosperm of a triploid nature (1 male and 2 female elements) is as follows:



- I  $AAa$  = formula of hybrid when maternal parent is an individual A  
 II  $aaA$  = formula of hybrid when maternal parent is an individual a.

Thus we see that the hybrid I has 2 determinants of blue: AA will therefore have darker seed than the hybrid II with 1 determinant: A. On the other hand, following the old formula: I)  $Aa$  and II)  $aA$ , the two different shades of blue could be explained to some extent by admitting a



dominance on the maternal side, but in reality this dominance does not exist.

The zygotic constitution of the hybrids of  $F_2$  (the 2<sup>nd</sup> hybrid generation) is shown by the following diagrams:

*Zygotic constitution of hybrids of the  $F_2$  generation.*

Male determinants		Male determinants	
Female determinants	♂	♀	
	A	a	
	a		
	A	AA	aA
	a	Aa	aa
	Zygotes		Zygotes
	I.		II.

In diagram I, the number of male and female determinants is supposed to be identical, and there are thus only 2 kinds of blue zygotes;  $AA$  and  $aA$  or  $(Aa)$ .

On the other hand, in diagram II, where the triple character of the endosperm is shown on one side, by the male determinants  $A$  and  $a$ , and on the other, by the pairs of female determinants  $AA$  and  $aa$ , the number of the blue zygotes is 3:  $AA A - AA a - Aaa$ , so that in the  $F_2$  generation, 3 different shades of blue can be distinguished.

This new conception explains the variety of shades in the colour of the grain produced by maize hybrids.

These observations regarding the character of the endosperm are applicable, not only to *Zea Mays*; but also to species of the genus *Triticum* and, in a general manner, to all Angiosperms in which more than 2 nuclei take part in the formation of the nucleus of the primary endosperm cell.

424 - Transmission of Characters in the Hybrid, *Nicotiana Tabacum*  $\times$  *N. sylvestris*. — GOODSPEED, E. H. and CLAUSEN, R. E., in *The American Naturalist*, Vol. LI, No. 601, pp. 31-46; No. 602, pp. 92-102. New York, 1917.

The researches of MORGAN and his associates on the transmission of hereditary characters in *Drosophila ampelophila* have clearly shown that the factors of heredity present in the chromosomes form a linear series of loci which cannot displace, or replace, one another, and are united in a balanced system. The relative position of some of these loci have even been determined. When a change occurs in some locus, a corresponding change of some sort may occur in somatogenesis, so that the individual that develops from such a set of factors with the changed locus, differs in some particular way from an individual which develops from the normal unchanged series of loci; and as previously remarked, the total of the factors forms a balanced and, reacting system, so that any change in one of

the elements reacts more, or less, upon the other elements. This fact somewhat modifies the present view respecting Mendel's 3rd. law, that of the recombination of characters. In fact, the varied and easy exchange of characters and elements between one individual and another which is permitted by this law, clearly contradicts the idea of a balanced system in which, by even a slight change in the locus of the factors of heredity, somatogenesis would be interfered with, and the development of a normal individual prevented. The law of the splitting and the recombination of characters, in the mendelian sense, can only be applied in a case in which the reacting systems of the 2 individuals present the closest cytological and physiological analogy. The less complete this analogy, the more each system will tend in the phenomena of character transmission to behave as an indivisible and unchangeable unit, and exclude a continually increasing number of combinations, that is to say, to be dominant.

From this point of view, the hybridisation experiments made by the writers at the University of California on two *distinct species* of *Nicotiana*, *N. Tabacum* and *N. sylvestris*, are of great interest. The transmission phenomena displayed by these hybrids admit of a consistent explanation, if we regard them as the outcome of a contrast of 2 distinct Mendelian reaction systems, the elements of which cannot be freely interchanged without profoundly affecting the general functions of the reaction systems thereby resulting.

When *N. Tabacum* var. *macrophylla* is crossed with *N. sylvestris*, the hybrids of the  $F_1$  generation display throughout, down to the smallest details, the anatomical and physiological type of *N. T. macrophylla* (with no trace of *sylvestris*) namely: rose-red flowers — pentagonal limb, short, stout corolla tube, etc.

If on the contrary, *N. Tabacum* var. *angustifolia* is crossed with *N. sylvestris*, the hybrids are completely different from the preceding ones, on account of the entire predominance of the characters of *N. T. angustifolia* — pink flowers; leaves ovate-lanceolate, not erect like those of *N. sylvestris*, but graceful and drooping.

On the other hand, the  $F_1$  hybrids of *varieties of the same species*: *N. Tabacum*, present intermediate characters with no predominance of the characters of either variety. In this case, there is not a contrast between two distinct Mendelian reaction systems, but merely a contrast of certain differences within a common system, and the differences are due to slight variations in one factor, or in a very limited number of factors.

In *species* hybrids, however, the contrast is between distinct Mendelian reaction systems of which the elements form an unchangeable physiological whole, and one of these systems entirely predominates over the other.

A high degree of incompatibility between the factors (loci of the system) is shown by sterility in the  $F_1$  generation. As GOODSPEED has shown, it is not a question of complete, but only of partial, sterility, with the formation of some ovules which are capable of fertilisation and development. The small number of fertile ovules and pollen grains represent the extreme values of recombination between *N. Tabacum* and *N. sylvestris*. On the

other hand, in the majority of cases, given the incompatibility of the two systems, the gametic combinations that can be theoretically predicted are of no functional importance, and give rise to sterile elements.

425 - **Hereditary Anomalies of the Flower of *Nicotiana Tabacum* Observed in Germany.** — KLEBS, GEORG, in the *Zeitschrift für induktive Abstammungs und Vererbungslehre*, Vol. 17, Pt. 1-2, pp. 53-117. Leipzig, November 1916.

This paper describes hereditary anomalies in the flower of a stock plant of *Nicotiana Tabacum*, which, in the spring of 1909, grew fortuitously in a green-house in a pot where tropical plants were cultivated. Although *Nicotiana Tabacum* is annual, the plant in question grew during 3 consecutive years and flowered 6 times. It died in March, 1912, after the capsules had ripened. The plant was very carefully observed from 1909 to 1912 and, throughout its existence, proved extremely typical. Cuttings from this plant, grown in a warm bed under special conditions, showed many anomalies, some of which proved of importance in subsequent observations.

Seeds were obtained from the plant by self-fertilisation and sown for the first time in the spring of 1910. On superficial examination the 80 plants showed no peculiarities. The second sowing was carried out in February 1912, with seeds of the same plant in unsterilised soil. The seedlings were then transplanted in the open, partly under different conditions.

Among the 460 samples cultivated in the open the flowers of one plant showed an abnormal structure (mutation), which the author called "*lacerata*" form. All the other subjects showed concordant characteristics, both in vegetative structure and general organisation of the flowers. The mutation only differs from the typical ("*typica*") stock form in the flowers, the difference being quantitative. Its most characteristic peculiarity is that, in 50 % of the flowers, the corolla is crenated or torn at the side, a condition found only in from 0.2 to 2.6 % of the "*typica*" form. Other abnormal characteristics of the calyx are still more marked. The "*lacerata*" form may be defined as an intermediary type, "rich in anomalies" whereas the "*typica*" form may be called "poor in anomalies".

In 1913, new descendants of the stock plant (446) were obtained; 967 flowers were examined 2.6 % of which showed crenated corollas. In 1914, the percentage of this anomaly was 0.23, and in 1915, 0.25.

The subsequent behaviour of the "*lacerata*" form is of special interest. By means of self-fertilisation it produced three types of descendants, the percentages for which are given below: —

	1913	1914	1915
<i>lacerata</i> . . . . .	56.0 %	47.5 %	50.6 %
<i>typica</i> . . . . .	29.7	38.1	29.5
<i>apetala</i> . . . . .	14.3	14.4	19.0

From this segregation the author concludes that the "*lacerata*" form is a hybrid of the *Zea* type, but with certain deviations. It is derived, by mutation of the hybrid, from the "*typica*" form.



New hybridisations were carried out to study the nature of these forms. In 1914, by crossing the stock plant with the "*apetala*" form, 134 plants were obtained, all of which showed the "*lacerata*" character. In 1915 these plants separated out in the following proportions:

<i>lacerata</i> . . . . .	50.0 %
<i>typica</i> . . . . .	31.1
<i>apetala</i> . . . . .	18.9

By reciprocal crossing of the "*lacerata*" form with the "*apetala*" form, 54.7 % of "*lacerata*" forms, and 45.3 % of "*apetala*" forms, were obtained. This is in agreement with Mendel's law. Reciprocal crossing of "*lacerata*" with "*typica*" has not yet given concordant results.

426 - **Behaviour of Tobacco "Variations", in Java.** — JENSEN, H., in *Proetstation voor Vorstenlandsche Tabak, Mededeeling* No. XXIV, pp. 41-56. Semarang, 1916.

A description is given of experiments carried out to ascertain whether *Nicotiana Tabacum* plants with abnormally long or short stems and abnormally large or small blades, transmit these peculiarities to their descendants. In other words, the aim was to determine whether positive and negative variations are fluctuations due to the irregular action of external agents, and, consequently, untransmissible, or whether they are true mutations, due to a modification of the germ-plasm and transmitted to the descendants with ever increasing distinctness. In the second case, the breeder could make use of the variations to improve a given variety, whereas, in the first case, they would be of no practical use. The work may be divided into two parts: —1) the consideration of the length of the stems, 2) the consideration of the dimensions of the blades.

I. — **LENGTH OF THE PLANTS.** — Experiments were begun in 1913 on 6 samples of which 2 (Nos. 35 and 38) were of the pure strain  $Y_{10}$  isolated by LODEWIJKS, and 4 (Nos. 34, 36, 37, 39) derived from the 3rd. generation of the pure strain WY, descended from plant No. 27, selected in 1911. Certain descendants of this plant (Nos. 201, 216, 218) had been set aside in 1912, and, in 1913, the 4 above-mentioned samples, Nos. 34, 36, 37, 39 had been isolated from among the descendants of Nos. 201, 216, 218, to serve as parent plants in these experiments. The lengths of the 4 samples were as follows: —

No. 34 (descended from plant No. 218 of 1912) . . . . .	119 cm.
No. 36 (descended from plant No. 216 of 1912) . . . . .	118 cm.
No. 37 (descended from plant No. 201 of 1912) . . . . .	142 cm.
No. 39 (descended from plant No. 201 of 1912) . . . . .	224 cm.

Nos. 37 and 39, therefore, had the same mother, and all four samples the same ancestor (No. 27). Taking into consideration the close relationship and the identity of the resulting biotypical formulae, the variations could only be fluctuations or mutations. If it is a case of fluctuations there should be no real differences between the descendants of long and of short individuals in the average length and the value of the deviation

from the average. If, on the other hand, it is a question of mutations, the longest and the shortest individuals will tend to procreate long individuals and short individuals respectively, and the average lengths of the two groups of descendants will differ notably one from the other.

Table I gives a summary of the biometrical data concerning the stem.

TABLE I. — *Biometrical Data Concerning the Stem of the Strain WY.*

Parent Plants		Descendants			
Numbers	Length	Average Length	Average error in the determination of this length	Deviation from the average	Variation coefficient
34	119 cm	227.08 cm	0.77	10.160	4.47
35	72	223.11	0.91	12.065	5.41
36	118	231.74	0.75	11.229	4.85
37	142	203.36	0.99	13.376	6.57
38	224	219.24	0.63	8.308	3.79
39	224	208.89	0.85	11.585	5.56

Although external conditions, and, above all, irregularities of the soil, may have influenced the development of the plants, making analysis more difficult, yet examination of these data shows that there is no proportionate difference between the descendants of long and of short individuals. In some special cases, long samples produced shorter descendants than certain short samples. It would appear, therefore, that, in tobacco, variations in the length of the stem are non-transmissible fluctuations.

II. — DIMENSIONS OF THE BLADES. — The investigations were begun in 1913-1914 on a pure "Kanari" strain and a Y strain, in all 55 544 leaves being measured in length and breadth.

For the "Kanari" strain a plant of the 7th. generation with the number 118 was taken as starting-point. In this plant the ratio *length* : *breadth* of the blade equalled 1.8, that is to say, for the "Kanari" type, it had relatively broad leaves. From among the descendants of this plant (8th. generation) 27 were selected, of which No. 7 had a ratio of 2.1 (narrow leaves), and No. 14 a ratio of 1.9 (broad leaves). These were, therefore, two individuals which, although belonging to a pure strain, showed very strong variations. In 1913-1914, 5 490 leaves of No. 118, 11 786 leaves of No. 14 and 12 382 leaves of No. 7 were measured. The biometrical data are given in Table II.

Table II shows that, in 1913, the leaves of the whole plantation were relatively little developed (on account of meteorological conditions), and no difference in the behaviour of the various descendants can be distinguished. The biometrical values of the different groups are equal. It is thus

TABLE II. — *Biometrical Data Concerning the Leaf of the "Kanari" Strain.*

Parent Plants		Progeny				
Number	Length Breadth Ratio of Blade	Number of leaves measured	Length Breadth ratio of blade	Average error in the determination of this ratio	Deviation from average	Variation coefficient
No. 118 (1911)	1.8	5 490	2.2435	0.02276	0.2276	10.1
No. 14 (1912)	1.9	11 786	2.2520	0.02288	0.2288	10.1
No. 7 (1912)	2.1	12 382	2.2577	0.02293	0.2293	10.1

seen that the genotype of the pure "Kanari" strain is not subject to permanent modifications with regard to the "dimensions of the blade", so that plants with wide leaves and plants with narrow leaves produce descendants showing no difference in the dimensions of the blade.

The starting point for the strain W Y was No. 27 with small leaves and a *length : breadth* ratio of 2.05. From amongst its descendants two plants were chosen; one with very wide leaves No. 207, and one with rather small leaves, No. 202. The descendants of Nos. 27, 207 and 204 were studied comparatively in 1913. The most important biometrical results are summarised in Table III.

TABLE III. — *Biometrical Data Concerning the Leaf in the Strain WY.*

Parent Plants		Progeny				
	Length Breadth ratio of blade	Number of leaves measured	Length Breadth ratio of blade	Average error in the determination of this ratio	Deviation from average	Variation coefficient
No. 27	2.05	5 391	2.2238	0.02174	0.2174	9.77
No. 207	1.82	10 178	2.2435	0.02232	0.2232	9.95
No. 204	1.98	10 317	2.2808	0.02185	0.2185	9.58

CONCLUSION : — The descendants of both positive and negative variations differ in no way among themselves and show the same average dimensions. In the choice of plants for seed, therefore, where pure strains are concerned, it is unnecessary to take into consideration either the length of the stems or dimensions of the leaves, for neither of the features are transmitted to the progeny.



427 - The Behaviour of "Bolting" Beets. — MUNERATI, O. and ZAPPAROLI, T. V., in *Le Stazioni Sperimentali Agrarie Italiane*, Vol. I. Part. I, pp. 5-24. Modena, 1917.

After giving a rapid review of the chief work already done on this subject the authors describe the experiments which they themselves carried out at the "R. Stazione Sperimentale di Bieticoltura" of Rovigo (Royal Experimental Station for Beet Cultivation).

In 1912, by means of the isolator invented by Prof. MUNERATI to prevent the cross-fertilisation of parent beets, a fairly large number of annual plants in flower were isolated, and seed was obtained from about 40 samples.

In the spring of 1913 the glomerules of these samples were sown in separate plots. In this first generation a great difference was immediately evident between the various groups in the percentage of beets which flowered in the first year. At harvest time this percentage varied from 0 to 95.

The question arose as to whether the tendency to transmit premature flowering was connected with precocious production of the flowering shoot or shoots. The following facts were largely observed in all beet-fields in which the plants bolted:

a) Bolting plants nearly always have a single, very strong shoot with but few leaves, or having few leaves only at the base, and a thin, and usually more or less woody, root. These are plants which, in the Lower Valley of the Po where beets are sown in the last days of February or the first fortnight of March, have their seeds already ripe in the first fortnight of August.

b) plants which usually seed late have a stem abundantly covered with leaves and with many leaves at the base, a thick root, similar to that of biennials, which is but slightly or not at all woody. Under the same conditions the seed ripens only towards the middle of October, or even later.

c) plants with a more or less elongated stem terminating in a rosette; these are called "rosettes".

In 1913 the authors isolated several plants of the *a* and *b* groups. The seed was harvested *a*) in the middle of August (early) — *b*) from the middle to the end of October (late), respectively. At the same time a certain number of the "rosettes" *c*) were kept, and fructified under an isolator in the following year (1914).

The seed of groups *a* and *b* was put into the ground on the 4th. March, 1914. The crop obtained showed that beets with a tendency to bolting transmit their character to their descendants to a much more marked degree than those which seed late.

The experiments were continued in 1914 on the following bases:

a) the gathering in common sugar beet fields, as in the preceding years, of samples which were going to seed, the early and late flowering ones being kept apart and successively separated;

b) the isolation of annuals, early or late, according to strains derived from annual plants;

c) the gathering in mass of the seeds from early or late annual beets descended from strains of annual beets ;

d) the fructifying of the 1913 "rosettes" in isolators.

The sowing of these seeds was carried out twice in 1915, on the 5th March and the 26th April. The number of biennial and early and late annual plants and the percentage of annuals were determined for each variety.

The flowering periods of the cultivated beet were compared with those of the wild beet (*Beta maritima*) with the following results :

Date of sowing	Percentage of annuals obtained	
	from wild beet seed	from common cultivated (biennial) beet seed
February 23rd . . . . .	85.5	12
March 15th . . . . .	82	2
March 28th . . . . .	82	—
April 28th . . . . .	79	—
June 14th . . . . .	39	—
August 9th . . . . .	—	—

When sown very early, then, wild beet may give as much as 90 % of annuals and cultivated beet from 10 to 15 %. When sown fairly late, cultivated beets produce only biennial descendants, whereas wild beets still give a good proportion of annuals. Finally, when sowing is very late, even the wild beet ceases to produce annuals. So far as the influence of the date of sowing is concerned, therefore, the wild beet reproduces the character of the cultivated beet, but to a much more marked degree.

The descendants of annual beets derived from biennial beets sometimes resemble the wild type, sometimes the cultivated type in their behaviour, the former may even surpass the wild type. Thus, in 1916, 98 and 91 % of annuals were derived from 2 strains of biennial beets respectively as opposed to 82 % obtained from the seed of wild beets.

These results led to the following conclusions :

1) The contrary results obtained by other workers who have studied the progeny of annual beets derived from biennial may be due to differences in the plant material from which these workers started.

2) By isolating the plants in flower and by studying the descendants in separate strains, it is possible to verify amongst the descendants themselves a behaviour which varies distinctly according to the plants from which they are derived ;

a) there are annuals the greater part of whose progeny show a tendency to bolting ;

b) there are, on the other hand, bolting plants, whose descendants, under the same conditions as the preceding plants, prove, almost without exception, to be biennials.

3) In a general way, given similar conditions :

a) bolting beets have a greater tendency to produce annuals (these beets are nearly always characterised by the absence or small number of leaves at their base and on the stems, by small, thin roots of more or less woody tissue) ;

b) beets which seed late rarely transmit to any marked degree the tendency to produce annuals (these beets usually have abundant leaves along the stems and at their base, the weight of the root is normal and its tissue is only slightly, if at all, woody) ;

c) beets descended from the "rosette" type, show this tendency either to a very slight extent or not at all (1).

4) In all cases, under similar conditions, beets which bolt in certain years (a phenomenon which is still unexplained) produce descendants in which the tendency to perpetuate this characteristic is more sharply defined than in the descendants of plants which bolt in other years.

5) As the beet, both when cultivated and when wild, produces annual as well as biennial, or even perennial types, it is not possible, strictly speaking, to say that cultivated bolting beets show a return to a primitive type (2). It can only be said that, in the wild type, the equilibrium tends towards annual production and, in the cultivated type, to biennial production. It is, however, easy, both in the wild and in the cultivated type, to obtain strains in which the annual character dominates and vice versa, by starting respectively from plants having the opposite characteristics.

6) Early sowing, followed by inhibition of growth, increases the proportion of bolting plants in every case. When, however, the equilibrium of a given strain tends towards annual production, early sowing and inhibition of growth no longer form a *necessary* condition for the production of a high percentage of bolting plants ; this percentage is obtained with both early or relatively late sowings. If, in the Lower Valley of the Po, the seeds are sown towards the end of April, that is to say, when variations in temperature will no longer cause any appreciable inhibition of growth (3), these strains yield more than 90 % of annuals, about the same percentage as would have been obtained had they been sown two months earlier. Still later sowing (from the end of May to the beginning of June) causes a rapid decrease in seeding plants, even eliminating them entirely. In this case the biennial characteristic is purely transitory.

7) Although it is relatively easy to increase or diminish the tendency

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(1) A large number of "rosettes" is obtained by sowing annual strains late; in this case, which fundamentally differs from the one under consideration, the progeny of the "rosettes" repeat the bolting characteristic. Experiments are being made to determine whether, by very early sowing, it is possible to obtain the annual characteristic to an appreciable extent in the descendants of "rosettes" from a normal sowing.

(2) The term "prefloration", which is perfectly suitable when the beet is considered in its customary aspect of a cultivated plant of a biennial cycle destined to commercial uses, is no longer appropriate when the phenomenon is considered from the point of view above.

(3) Common sugar beets, if sown towards the end of April, give exactly 100% of biennials.



of varieties towards an annual or a biennial character by special conditions (germination period, inhibition of vegetation, soil fertility, shade, etc.), it is not possible to fix the respective annual (1) or biennial characteristics in any stable or absolute manner. In other words, the beet belongs to that category of species described by DE VRIES as "unfixable", "facultatively annual or biennial", in which "continuous selection does not free biennial strains from the tendency to bolt, nor annual strains from their tendency to produce biennials". (*Mutations-theorie*, I, pp. 616-626).

The bolting of beets is thus reduced to one of the simplest and most natural manifestations of the life of the species.

CEREALS  
AND PULSE  
CROPS

- 428 - **A New Method of Wheat Cultivation Advocated by Mr. Devaux** (2). — SCHRIEBAUX (Professor of the National Agricultural Institute), in *La Vie agricole et rurale*, No. 10, pp. 177-178. Paris, March 9, 1917.

The method advocated by MR. DEVAUX (that advised by DEMT-SCHINSKY in Russia) requires to be carefully carried out and, for this reason, cannot be adopted extensively. Moreover, very early sowing, in August or the first days of September, is but rarely possible because the ground is either occupied by other crops or is still insufficiently prepared. Early sowings also suffer from the winter cold, the attacks of insects and trampling. The multiplication of the culms delays the development of the wheat, and, with thin sowing and hilling up there is danger of scorching. The grain, too, would be of inferior quality. Abundant tillering is recognised to day as a fault, not as a good quality.

The method advocated by MR. DEVAUX may be recommended when it is necessary to increase the production of a new variety of wheat of which only a few seeds are available, but it is neither possible nor advisable in cultivation on a large scale.

- 429 - **Results of Experiments on the Cultivation of Spring Wheats at Valdichiana, Tuscany, Italy.** — VIGIANI, DANTE, in *L'Agricoltura toscana*, Year VIII, Pt. 2, pp. 25-26. Florence, January 31, 1917.

Many experiments in the cultivation of spring wheats were carried out in different districts of Valdichiana (province of Arezzo), particularly in the grounds of the Vegni Agricultural Institute at Barullo. From these experiments the success of spring sowings was seen to depend on special factors: abundant sowing (116 to 142 lbs. per acre) never later than the first days of March; manuring with superphosphates; weeding. The most important of these factors is early sowing; in Valdichiana the most

(1) It should be noted that, in 1876, RIMPAU obtained 100 % of annuals from a strain which was chiefly annual, sown on the 31st March. (*Das Aufschliessen der Runkelrüben*, in *Landwirtschaftliche Jahrbücher*; Band V (1876), Heft 1: Band IX (1880), Heft 1, but the number of plants observed, barely 50, was too limited to permit this percentage to be accepted as typical.

(2) M. DEVAUX: 1) Cultural Methods which give a large increase in wheat yield, in *Comptes Rendus de l'Académie des Sciences*, January 22, 1917. — 2) "The Effects of Early Sowing, hilling-up and Topping on the Growth of Wheat", in *Comptes Rendus de l'Académie d'Agriculture de France*, January 24, 1917.

See also *B.* April, 1917, No. 327.

(Ed.).

favourable month is February ; when sowing was as late as the end of March the results were disastrous. The following varieties were found most subject to rust: - first "Noè marzuolo", then, in order, "Ferrarese", "American", "Chiddam", "Marzuolo dell'Amiata", "Marzuolo comune", "Veronese", "Marzuolo della valle del Savio".

The best results were obtained with "Marzuolo americano" and "Monte Amiata", both of which tend to tiller rather more than the other varieties. The variety "Gentil rosso" ("Calbigia rossa") often recommended as a spring wheat, was found to complete its vegetative cycle in a short time.

430 - **The Importance of the Awns of Native Wheat in Hungary and of Barley in Sweden.** — I. FLEISCHMANN, RUDOLF, The Importance of the Awns in Native Hungarian Wheat, in *Zeitschrift für Pflanzenzüchtung*, Vol. 4, Pt. 4, pp. 335-346. Berlin, December, 1916. — II. TEDIN, HANS, The Effects of the Removal of the Awns on the Development of Barley Grain, Sweden, in *Sveriges Utsädeförenings Tidskrift*, Year XXVI, Pt. 6, pp. 245-253; Malmö, 1916.

I. — **THE IMPORTANCE OF THE AWNS IN NATIVE HUNGARIAN WHEAT.** While selecting this wheat the author isolated forms which showed remarkable differences in the awns. In order to determine these differences with greater exactitude he chose, from among many stock types, 3 average ears of each which best showed the configuration of the awns. On each of these he measured the length of the awn and the length of the glumes.

The strains studied were then divided into 3 type-groups according to the ratio "length of awn" : "length of glume" (without awn) :

*A* : Complete absence of awns. Tip of the glume either completely rounded or showing only a small spur-shaped projection which cannot be called an awn. This is the "A type", or "hooded type" ("Kapuzentypus").

*B* : Distinct awns, but of an average length less than, or, at the most, equal to, the average length of the glumes (without the awn). This is the "B type", or "short-bearded type" (Kurzgrannentypus).

*C* : Average length of the awns exceeding that of the glumes. This is the "C type", or "long-bearded type" (Langgrannentypus).

Attempts were made to determine whether there is any correlation between the length of the awn and certain important agricultural qualities of native Hungarian wheat, and the following facts were established :

1) Both the ears and leaves of the "A hooded type" are much less resistant to yellow rust than types *B* and *C*.

2) Plants giving a low yield are more frequent in type *A* ; those giving a high yield are more frequent in types *B* and *C*.

3) The weight of 1000 grains is less in plants of type *A* than in those of types *B* and *C*.

No correlation could be established between the weights of 1 hectolitre of grain.

4) The average diameter of the grain is less in type *A* than in the types *B* and *C*.

5) Type *A* has shorter straw than types *B* and *C* ; it is also of a weaker and finer structure.

6) Type *A* usually ripens before the other types.

7) Forms related to type *A* appear, on an average, to be less susceptible to smut, but no exact correlations could be established.

In a general way, plants of type *A* remain within the limits characteristic of native Hungarian wheat. The ear is generally weak and delicate, in accordance with the whole structure of the plant. In years when rust is not rife these forms give a good grain of high quality but their susceptibility to yellow rust compromises the security of the crop.

Types *B* and *C*, on the other hand, show a great difference in development and diverge more or less from the ordinary native Hungarian wheat. They are vigorous types, with abundant vegetation and with a longer straw, larger and heavier grains than type *A*. They are more resistant to rust and much more productive.

It is still too early to give any definite opinion on the value of the two types *B* and *C* from the point of view of selection. Further experiments are necessary, particularly the testing of the characteristics and value of the descendants. It seems, however, permissible to assume that, in selection, better results may be obtained from type *C* than from type *B*.

II. THE EFFECTS OF THE REMOVAL OF THE AWNS ON THE DEVELOPMENT OF BARLEY GRAIN, SWEDEN. — It is known that removal of the awns immediately after earing changes the transpiration process and also greatly influences development of the grains, their quality and their quantity.

On the 3rd. and 4th. August 1916, just when the barley was about to ripen, a district of Sweden, which included Svalöf, suffered from two violent gales during which the wind sometimes attained a velocity of nearly 2 miles a minute. Great damage was done to cereals at Svalöf; culms were broken, the grain fell and, above all, there was partial or total loss of awns.

Although development was very advanced the loss of the awns did not fail to influence the phenomena of growth and caused a rapid and irregular ripening of the grain while the straw was still green, especially round the nodes. Attempts were made to determine the total amount of damage due to loss of the awns. The most important results are given in the following table:

*Losses in Weight of Barley Grains at Svalöf due to Removal of the Awns.*

Varieties of Barley studied	Weight of 1 000 grains		Loss due to removal of the awns	
	from ears with awns	from ears stripped of their awns		
Svalöf's Prinzess . . . . .	43.3 g.	39.8 g.	3.5 g.	8.1 %
» Chevalier II . . . . .	45.7	38.9	6.8	14.9
» 0184 . . . . .	46.5	42.0	4.5	9.7
» 0187 . . . . .	46.4	41.9	4.5	9.7
» 0250 . . . . .	39.3	38.0	1.3	3.3
» 0412 . . . . .	46.9	42.8	4.1	8.7
» <i>id.</i> . . . . .	47.5	37.8	9.7	20.4
» Gullkorn . . . . .	41.7	39.8	1.9	4.6



This table shows that, without exception, the weight of 1000 grains is less in barley from ears stripped of their awns. The decrease varies considerably in the different varieties with a maximum of 20.4 % for "Svälöf's" 0412" and a minimum of 3.3 % for "Svälöf's 0250".

It may not prove impossible to increase the robustness and resistance of the awns by suitable crossings so that they may constitute a valuable characteristic in districts where gales and storms are frequent during the ripening period of cereals.

431 — **Wild and Cultivated Fodder Crops of the Bombay Presidency, India.** — I. MANN, HAROLD H., Fodder Crops of Western India, in the *Department of Agriculture, Bombay, Bulletin* No. 77 of 1916, pp. 142. Poona, 1916 — II. BURNS, W., BHIDE, R. K., KULKARNI, L. B. and HANMANTE, N. M., Some Wild Fodder Plants of the Bombay Presidency. *Ibid Bulletin*, No. 78 of 1916, pp. 24 + XXXIV plates.

FORAGE CROPS,  
MEADOWS  
AND PASTURES

I. — This paper gives a compilation of what is at present known concerning the most suitable fodder crops in various parts of Western India, particularly in the Bombay Presidency. Special consideration is given to the locality in which each crop is likely to prove most useful, the best methods of cultivation, the yield hitherto obtained and the value of the fodder produced.

The following plants have been studied:

GRAMINACEAE: "Jowar" (*Andropogon Sorghum*) — Maize — "Bajri" (*Pennisetum typhoidem*) — "Kang" or "Rala" (*Setaria italica*) — "Cheno" (*Panicum miliaceum* and *Panicum miliare*) — "Nachani" (*Eleusine coracana*) — "Sawan" (*Panicum frumentaceum*) — "Banti" (*Panicum Crus-galli*) — Oats — "Guinea grass" (*Panicum maximum*) — "Teosinte" (*Euchloena mexicana* = *Reana luxurians*) — "Baru" (*Andropogon halepensis*) — "Golden Crown Grass" (*Paspalum dilatatum*) — "Mauritius water grass" or "Para grass" (*Panicum muticum* = *P. molle* = *P. barbinode*) — "Rhodes grass" (*Chloris Gayana*).

The cultivation of the four following fodder crops is advised:

"Red Telf grass" (*Eragrostis abyssinica*) — "Sudan grass" (*Sorghum exiguum*) — "Elephant grass" (*Pennisetum purpureum*) — "Marvel grass" (*Andropogon annulatus*).

LEGUMINOSAE: Lucerne — "Berseem" or "Egyptian Clover" — "Shaftal" or "Persian Clover" (*Trifolium resupinatum*) — "Senji" (*Melilotus alba* = *M. indica*) — "Chavli" (*Vigna Catjang*) — "Val" (*Dolichos lablab*) — "Kulthi" (*Dolichos biflorus*) — "Guar" or "Cluster Bean" (*Cyamopsis psoraloides*) — Soybean (*Soya max* = *Glycine soya*) — *Pisum sativum* — "Methi" or "Fenugreek" (*Trigonella foenum-graecum*) — "Udid" (*Phaseolus mungo* var. *radiatus*) — "Mug" (*Phaseolus mungo*) — "Mat" or "Matki" (*Phaseolus aconitifolius*) — "Sann Hemp" (*Crotalaria juncea*) — "Florida Velvet Bean" (*Stizolobium Deeringianum*) — "Florida Beggar Weed" (*Desmodium tortuosum*) — "Japan Clover" (*Lepedeza striata*) — Vetch (*Vicia sativa*) — Sainfoin (*Onobrychis viciifolia*) — *Lathyrus sylvestris* var. *Wagneri*.

II. — This bulletin gives a concise description of the following wild plants used in India either as hay or pasture. The local name, habitat, life history, chemical composition, feeding value and a plate of each plant is given:

*Andropogon annulatus* — *A. monticola* — *A. triticeus* — *A. contortus* — *A. pumilus* — *A. pertusus* — *A. Lawsoni* — *A. purpureo-sericeus* — *A. halepensis* — *Ischaemum pilosum* —

*I. sulcatum* — *Iseilema Wightii* — *Iseilema antheophoroides* — *Panicum Isachne* — *Chloris barbata* — *Chloris virgata* — *Paspalum sanguinale* — *Dinebra arabica* — *Pennisetum cenchroides* — *Cenchrus biflorus* — *Apluda varia* — *Thelepogon elegans* — *Eleusine aegyptiaca* — *Anthistiria ciliata* — *Indigofera glandulosa* — *I. trifoliata* — *I. linifolia* — *Alysicarpus pubescens* — *A. rugosus* — *A. longifolius* — *Psoralea corylifolia* — *Sesbania aculeata* — *Hylandia latifolia* — *Tephrosia purpurea*.

432 - **Transplanting Alfalfa.** — HANSEN, N. E. in *Agricultural Experiment Station, South Dakota State College of Agricultural and Mechanic Arts, Department of Horticulture, Bulletin No. 167*, pp. 424-445, Fig. 8. Brookings, South Dakota, June 1916.

In the spring of 1907, the writer bought small lots of new alfalfas from Siberia and other parts of Russia. As it was very necessary that as large an acreage should be obtained as possible, the alfalfa was planted in rows, and the ground was kept clean and hoed. These transplanted individuals made such tremendous growth, that the writer has continued to work along this line, and in the spring of 1912, he started the machine transplanting of alfalfa.

Three different makes of transplanting machines were tried, but the best results were obtained with the Bemis transplanter made by the MADISON PLOW COMPANY, Madison, Wisconsin. This machine is now extensively used for transplanting tobacco, cabbages and other vegetables, various flowering plants and bulbs, as well as for small tree seedlings and cuttings. The many uses to which this machine can be applied make it also very useful to nurserymen. There are now about 100 000 transplanting machines in use in the United States and other countries. One of these machines can transplant from 7 to 8 acres of alfalfa per day; a small one costs about \$ 70.

The illustrations accompanying the article show the large dimensions attained by the transplanted alfalfa: the stems measured 7 ft. 2 in, and the much-ramified root, about 40 inches in length, while the dry weight was 8 lbs. One plant of the Cossack variety bears 3 oz. of seed the third year, if transplanted the first year from seed. This is at a rate of 1 022 lbs. of seed per acre.

In order to obtain good results from transplanting, a variety must be chosen which will respond to being given plenty of space. Common alfalfa does not stool out or branch enough. The Russian varieties Cossack and Semipalatinsk are very suitable for this mode of cultivation; the latter does well on the driest uplands. The writer is of opinion that the transplanting of alfalfa will be the means of reclaiming millions of acres of dry land, or of very argillaceous soil where now it is difficult to get a stand. The method is also effective as a means of attaining various ends: better seed production, inoculation, hybridising, etc.

Transplanting may be carried out in the autumn of the first year. Plants which it is impossible to transplant should be kept in outdoor cellars, or may be heeled-in close together in furrows made with a plough. The writer has transplanted as late as early June with good results; it is, however, better to set the plants before the new shoots have made too much growth. The plants, as a rule, should be set 2 × 4 ft apart; for selection purposes they should be at a greater distance from one another, at least 4 × 6.

It is not necessary to water the plants after they are transplanted. If set in dry ground, they will keep alive for many days until rain comes. The Semipalatinsk variety is especially tenacious of life in this respect. In autumn-transplanting, it is especially necessary to set the plants 2 inches deeper than they stood, so that the crowns are entirely covered with earth, this avoids excessive drying out during the winter. In spring-transplanting, the crowns should be barely covered, but enough to allow for settling of the loose earth.

Hay from transplanted alfalfa, while perhaps coarse-stemmed for the first 2 or 3 years, soon becomes fine, as the stems increase so quickly in number (often 500 by the 2nd. year). Further, the stems of transplanted plants are more leafy than in broadcast fields. Transplanted alfalfa ought not to be cut the first year, as the top is needed to give strength to the roots.

The transplanting method has led to a quick way of hybridising alfalfa. This is effected spontaneously by planting the 2 varieties alternately. In this manner, the writer obtained a hybrid between the yellow-flowered and the blue-flowered Siberian varieties which proved very resistant to the frosts of early autumn and of late spring.

The writer does not advise that alfalfa transplanting should be generally adopted. The method must be worked out slowly by the actual experience of many farmers.

According to the writer, the advantages of the transplanting system are as follows :

- 1) With an economy of seed, an alfalfa is obtained which, being strong and vigorous, at once takes possession of the soil and does not suffer, the first year, from the competition of dodder and other weeds.
- 2) When transplanted in autumn, the alfalfa occupies the ground for one season less. Thus another crop can be obtained in the rotation.
- 3) Transplanting is a sure manner of insuring inoculation.
- 4) Plants in hills may be kept cultivated and free from dodder and other weeds, so the seed raised from these plants is absolutely pure (100 %).
- 5) The roots and tops of these isolated plants attain a huge size, and consequently the seed is more abundant, plumper, and heavier and is thus of greater commercial value.

433 - **Experiments in Germany on the Determination and Yield of Red Clover from Various Sources** (1). — MÜLLER, KARL, in *Landwirtschaftliche Jahrbücher*, Vol. 50, Pt. 2, pp. 303-353. Berlin, December 18, 1916.

From 1913 to 1915, experiments were carried out in 6 different districts of the Grand Duchy of Baden with 4 varieties of red clover from different districts of southern and western Europe, in order to determine their agricultural value. For purposes of comparison 3 more varieties were used from

(1) See B., 1916, No. 169.

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central Europe and 1 from western Europe, making in all 8 varieties from the following sources :

- |                            |                    |
|----------------------------|--------------------|
| 1) Central France          | 5) Black Forest    |
| 2) Western France (Poitou) | 6) The Palatinate  |
| 3) Southern France         | 7) Styria          |
| 4) Italy                   | 8) Western Russia. |

The seeds, which were obtained commercially, all germinated well

The sowings of the same year gave similar results in the weight of 1000 seeds and in yield, that is to say, as a rule, a good weight of 1000 seeds corresponded to a high yield in seeds. The weight of 1000 seeds varies in the different varieties ; it might, therefore, be possible to use seeds of the same age to determine the source of origin. The size of the seed from year to year might also be used for the same purpose, especially in years distinguished by great climatic variations in the different countries of Europe.

The study of weeds in different clover crops did not confirm the assertion made by certain dealers that typical weeds, in the course of years, become acclimatised in countries other than their native country and, therefore, are of no use in determining the source of clover seeds. Seeds of typical weeds were found only amongst those varieties where their presence had been ascertained 15 years previously.

The varieties from southern Europe are distinguished by the presence of the following weeds ; *Arthrolobium* sp., *Torilis nodosa*, *Helminthia echinoides*, etc. These two last varieties are also found among red clover from western Europe (Poitou), but are absent from the mountain clover of central France, known commercially as " clover of the North of France ".

As was expected, the German types gave the best yield. The highest and most uniform yields were obtained from red clover from the Palatinate, which, consequently, is well adapted to permanent crops. Although it contained a large proportion of plantain seeds, the plots sown were completely free from weeds.

In the first harvest year the varieties from central and western France gave good yields even in the coldest districts. For this reason they are recommended for countries where clover is down for 1 year only. In many cases it is difficult to distinguish them from varieties of the south of Europe, but if *Arthrolobium* seeds are found there is no doubt that the clover comes from the south of France and is, therefore, unsuitable to the German climate. It is, therefore, important to be able to recognise this seed ; this may be done by cutting the tegument in two and examining the transverse section.

To determine exactly which French varieties are or are not adapted for use in Germany, they should be grouped according to the climatic regions from which they come, and not according to their geographical districts as has been done hitherto. It would then be more easy to trace the limit between varieties from central France (suitable to Germany), and those from southern Europe.

In spite of hard frosts the varieties from southern Europe used in the experiments did not die in winter as they are generally supposed to do. It is, therefore, probable that the plants are not killed by frost as they are said to be, but by attacks from the fungi *Glaciosporium caulivorum* and *Sclerotinia trifolium*.

No concordant results were obtained from experiments carried out to establish a correlation between the resistance to cold and the dry matter of varieties of red clover immediately before a frost.

- 434 - ***Trifolium Charrierii*. Coste, a New Natural Hybrid Clover Found in France** — COSTE, H., in *Bulletin de Géographie botanique*, Year 26, (Ser. IV), Nos. 325, 326, 327, pp. 1-3. Le Mans (Sarthe), January - February, 1917.

A new natural *Trifolium* hybrid may now be added to the two already described for the French flora: *T. Bertrandi*, derived from *T. medium* × *T. rubens* (from the Upper Saone) and *T. Neyrauti*, derived from *T. medium* × *T. mantanum* (from the High Pyrenees). This variety, found by M. F. CHARRIER at Savenay (Lower Loire), was identified by the author as a hybrid of *T. munitum* × *T. pratense*, and was described under the name of *T. Charrierii*. It is a perennial plant, about 30 cm. high, slightly hairy, with erect, branched stems. Its characters are intermediary between those of its parents.

- 435 - **The Cultivation of Bersim (*Trifolium alexandrinum*) in Egypt.** — See No. 462 of this *Bulletin* (1).

- 436 - **The Resources of Indo-China in Oil-Yielding Plants.** — BRENIER, in *Comptes Rendus des Séances de l'Académie d'Agriculture de France*, Vol. 3, No. 7, pp. 185-195. Paris, February 21, 1917.

M. BRENIER, Director of the Chamber of Commerce of Marseilles, gives some interesting facts concerning the resources of Indo-China in oil yielding plants.

From 1912, Germany imported 1 425 000 tons of oil-yielding seeds, whereas France, the chief importing country up to that date, only imported 1 219 000 tons in 1913, and England about 1 million tons. As the English oil-mills increased their producing capacity by 25 %, importations into England rose to 1 700 000 tons in 1915, but fell, in 1916, to 1 400 000 tons, still exceeding the French figures.

France has the greatest interest in finding in her colonies the raw materials necessary to the fat industry. From this point of view Indo-China offers resources of the greatest importance.

Among the plants grown, M. BRENIER mentions particularly the Chinese tallow-tree (*Stillingia sebifera*), which grows in the north of Tonkin and supplies white vegetable tallow, and the wild varnish (*Rhus succedanea*), a lac-tree cultivated in the province of Putho, whose seeds supply Japan with green vegetable tallow.

Amongst other trees capable of supplying raw material, though in small quantities only, may be mentioned; Mast-wood (*Calophyllum Ino-*

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(1) See also B., January 1917, No. 33.

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*phyllum*), in Cochinchina ; a species of Mahua (*Bassia* sp.) in North Annam ; *Camellia drupifera* in the same district and in Tonkin ; *Garcinia tonkinensis*, a native of Indochina ; soap-nut (*Sapindus Mukerosei*).

"Abrasin" (*Aleurites montana* or *A. Jordii*) should also be mentioned on account of the drying properties of its oil, which is superior to that of linseed, and because it is well adapted to village plantations in Central Tonkin.

The most interesting cultivated plants are : the cotton plant, *Hevea*, soya bean, castor oil plant, sesame, pea-nut, and coconut.

The cotton plant is cultivated in Indochina in the north of Annam, and in the province of Thanh Hoa, where the large population supplies abundant labour for the harvest. Large cotton-fields are situated at Cambodge, on the banks of the Kompong-Cham. Their produce, from 3 000 to 5 000 tons according to the year, is bought by Japan. The Lancashire mills use 500 000 bales of this cotton, which the English have introduced into India. Cotton seeds have a high value in oil yield, and when this plant is cultivated more largely at Cambodge, French buyers will be able to obtain large quantities of seed.

Five million *Hevea* plants have been put down. The Imperial Institute at London pointed out long ago the value of the drying properties of *Hevea* seed oil. The ratio of the yield in kernels to seed is 50 % and the yield of oil from the kernels is 42 % (laboratory tests). This produce is a secondary resource which should not be ignored.

The oil yield of the Cambodge soya bean is superior to that of Manchurian soya although it does not exceed 18 %. The castor-oil plant is of great interest in Indo-China. It is chiefly cultivated in Tonkin and is exported to Hong-Kong and the Far East. In laboratory experiments, 42 % of oil has been obtained, but by the European methods used in the few small mills of the country only 35 % is obtained. Castor oil is much in demand at the present time as a lubricant. The value of the cakes used as manure is well known. Analyses made at Saigon showed the presence of 4.75 % of nitrogen and 2.25 % of potassium.

*Sesame* is cultivated in Tonkin and Annam and might well be grown in Cambodge and Cochinchina. It gives a very high oil yield, sometimes as much as 50 %. Analysis shows the oil yield of Tonkin sesame to be very remarkable. The pure cultivation of sesame in Tonkin gives a yield of 9  $\frac{1}{4}$  cwt. per acre, whereas, in British India, where enormous quantities of sesame are exported, the yield from mixed cultivation is only from 4 to 4  $\frac{1}{2}$  cwt. per acre. From 1899 to 1903 the maximum annual importation of sesame into France rose to 139 000 tons.

In good years, as much as 420 000 tons of *pea-nuts* are imported into Marseilles ; this represents about a third of the French imports of fat. Although Senegal supplies 200 000 tons, this quantity does not nearly meet the commercial demands and its further cultivation in other colonies is, therefore, most desirable. Light soil, indispensable to the cultivation of the pea-nut, is found in Tonkin, Central Annam, Cochinchina and Cambodge. Experiments show the ratio of the shell to the whole seed to be



equal to that of the best African varieties (32 to 24 %). As the Annamite methods of cultivation are superior to the black ones, a higher yield is obtained than in West Africa. In Africa the yield is from 20 to 29 cwt., whereas in Indo-China it is as high as 39, or, in good soil, even 49 cwt. M. BRENIER imported from Java a pea-nut, which is very easily gathered on account of the grouping of the pods round the neck. This variety does very well in Indo-China, but appears to give a lower yield in oil than the ordinary pea-nut.

The *coconut-tree* covers more than 24 711 acres. It is grown chiefly along the Annam coast, which, being subject to typhoons, is not the most favourable site. The coconut grows along the south coast and also in the interior of Cochinchina, where its cultivation is localised in the towns of Mytho and Bentre. The coast of the gulf of Siam, outside the typhoon zone, appears to be the most favourable district for cultivating coconuts. The natives plant the trees much too close together so that, in Annam, the yield of one tree does not exceed 23 to 25 nuts, whereas in plantations owned by Europeans, where the trees are further apart, as many as 50 to 75 are obtained. The yield in copra and in "coir" (fibre obtained from the mesocarp) of the coconut trees of Indo-China competes closely with that of coconut trees in Malaya, Ceylon, the Indian Archipelago and the Antilles. As dessication causes a loss of 50 %, distinction must be made between the green kernel and the copra in estimating the yields. If copra is valued at £2 per 220 lbs. (its actual value is double that), the gross revenue from an average of 50 nuts per tree may be calculated at £10 per acre. If an average of 70 nuts per tree is taken, the revenue will be £14. The coconut tree bears fruit for 50 years. In the Malay Peninsula 1 acre of a European plantation is valued at about £25.

437- **Cultivation of the Olive Tree on the South Coast of the Crimea, Russia.** — Вульфъ, Е. В. (VOULF, E. V.), Калайда, Ф. К. (KALAJDA, F. K.) and Плотницкий, Г. А. (PLOTNITSKII G. A.) (Laboratory of the Nikitskii Botanical Garden, Ialta). Reprint from *Вѣстникъ Русской Флоры* (Russian Flora Messenger), Vol. II, No. 1, pp. 24, 9 fig. Ialta, 1916.

The climate and vegetation of the south coast of the Crimea are similar to those of the Mediterranean coast, and the favourable soil conditions make it possible to cultivate many crops giving a high yield. The cultivation of the olive goes back to ancient times, but in the 15th. century, under Tartar rule, it was completely abandoned. After the annexation of the Crimea by Russia, preference was given to the vine, and the olive orchards were not restored. At the beginning of the 19th. century attempts were made to reinstate olive cultivation, but with little success, and at the present time it is almost non-existent.

In view of the favourable climatic conditions (minimum temperature from 5 to 8° C., annual rainfall 14 1/4 inches; i. e., similar to that of other oil-producing districts), the Nikitskii Botanical Garden, founded in 1830, is making great efforts to increase the production of olives in the Crimea. To this end the Institute made a botanical examination of the different varieties of olive grown in its gardens. At present there are about 30 varie-

ties ; these will be added to later by those introduced from the Caucasus and other oil-producing districts. Olive trees are distributed free of charge, and the demand for them increases gradually. Whereas, a few years ago, only 50 or 60 trees were distributed annually, the figure now reaches 200.

The Garden cultivates, among others, the following 3 varieties :

- 1) *Razzo I* ; small olives.
- 2) *Razzo II* ; larger, violet-fleshed olives.
- 3) *Carreggiola* ; fairly large, brown olives.

The appended table gives the results of an analysis of the oils of these olives ; they are only preliminary, and will be controlled by subsequent research on these varieties as well as on others grown in the garden.

*Physical and Chemical Constants of the Oil of 3 Varieties of Olive Grown  
in the Nikitskii Botanical Garden.*

	" Razzo I "	" Razzo II "	" Carreggiola "
Specific weight . . . . .	0.9168	0.9100	0.9135
Solidification point . . . . .	— 12.6° C.	— 9.5° C	— 12.2° C
Moisture . . . . .	—	—	—
Viscosity . . . . .	17.5	13.30	15.5
Free fatty acids . . . . .	7.5	36.09	20.2
Saponification index . . . . .	178.3	182.00	185.7

The soil and climatic conditions, the economical-agricultural conditions of the south Crimean coast, and the results of experiments already carried out, all show that this district is well suited to olive cultivation, and the Nikitskii Botanical Garden is taking active steps to encourage it.

438 — **Experiments Made in the Province of Lecce, Italy, in order to Control the Unproductivity of Olive Trees.** — VALLESE, F. (Director of the Travelling Chair of Agriculture of the « Terra d'Otranto »), in *Cattedra ambulante d'Agricoltura di Terra d'Otranto, Esperimenti diretti a combattere l'improdduttività degli olivi*, Brochure of 31 pp. + 5 plates. Lecce, 1917.

The olive plantations in the Province of Lecce, especially to the south-east of Lecce, have long suffered from " Brusca " caused by *Stictis Panizzei* (1). This disease first appeared about a century ago, then about the middle of the 19th century, and then about 20 or 30 years ago, since when it has remained. It causes more or less extensive defoliation in olive-trees of the " Ogliarola " variety which become quite unproductive, while on the contrary the " Cellina " variety remain almost immune.

The question has been studied at various times by COMES, CUBONI, BRIZI and PETRI : Prof. COMES attributed the disease to the presence of gummosis and root rot and not to the parasite *Stictus Panizzei*, which he considered as merely of secondary importance. The other authors considered the disease to be caused solely by the above fungus. The subject was then left in suspense without any measures having been suggested in order to avoid, or at any rate, reduce the ill effects in question.

(1) See also on p. 1505 of B. 1913, the article by Prof. F. BRACCI on *Olive Growing in Italy*. (Ed.).

Unfortunately, a serious attack occurred of leaf spot ("occhio di pavone"), caused by *Cycloconium oleaginum* (1) which still further aggravated the already bad state of many of the olive plantations in the district.

In order to increase the productivity of the olives, the writer undertook two experiments: one in a plantation badly attacked by "brusca" and leaf spot, the other in a plantation solely attacked by the latter disease. The treatment, similar in both cases, consisted in manure together with mineral superphosphates, potassium sulphate and a leguminous green-manure, and spraying the leaves with copper-lime mixture in April and August.

In the first year of experiment, in spite of a visible improvement in the foliage, the olives yielded no crop, either on treated, or on control plots. On the contrary, however, in the autumn of the second year (1916), the treated olives yielded a crop much superior to that of the control olives. The crop was 42 litres of olives per tree in one of the test plots, and 69 in another, so that it not only paid for labour, manure, spraying, etc., during the two years of experiment, but left a certain margin of profit.

In addition, it was found that the treated olives gave a better oil-yield than the controls.

Further, in spite of the crop yielded in 1916, the olives seem as if they will produce equally well in 1917 to judge from their vigorous condition.

In one case, after a fresh attack by *Stictis* in one of the districts previously treated, it was found that trees that had been manured and sprayed suffered must less than the others.

The appended table gives the results of the two experiments.

### *Results of the two experiments.*

	Area in hectares (1)	Number of olive trees			Production				Yield in oil of 100 litres (%) of olives	
		"Celli- na"	"Oglia- rola"	total	of olives		of oil			
					total	per tree	total	per tree		
					litres	litres	kg	kg	kg	%
<i>Fellito plantation:</i>										
control . . . . .	8 ha	—	—	501	3 528	7.041	304	0.606	8.616	9.4
treated . . . . .	0.63 ha	9	32	41	1 848	45.073	224	5.463	12.121	13.2
<i>Coriglione plantation:</i>										
control . . . . .	20 ha	—	—	887	2 912	3.282	—	—	—	—
treated . . . . .	1 ha	38	5	43	3 136	72.930	—	—	—	—

(1) 1 hectare = 2.4711 acres. — (2) 1 litre = 2.2 gallons.

(1) See pp. 1561 and 1566 in *B.* 1913, the article by Prof. F. BRACCI on *Olive Growing in Italy*.



The account of these experiments is preceded by an introduction devoted to the discussion of the action of copper-lime sprays on the parasites of the olive. The writer agrees neither with those who attribute the fall of the leaves and the consequent unfruitfulness to *Stictis* and *Cyclomium*, nor with those who consider these fungi as epiphenomena, and in no way connected with the fall of the leaves. The writer draws the attention of the olive growers to this point : it is not only necessary to apply all the known prophylactic measures with great care to the olive trees, so as to increase their resistance to adverse conditions, but also to give them a therapeutic treatment, such as periodical sprayings with copper-lime mixture, so as to control " brusca " and leaf spot directly or indirectly, as well as other fungus parasites that attack the leaves, roots or even the flowers.

RUBBER,  
GUM AND RESIN  
PLANTS.

- 439 - **The Cultivation of *Cassia auriculata* as a Source of Tannin in British India.** — RANAWARA, S., and AVARAI, T., in *The Tropical Agriculturist*, Vol. XLVII, No. 6., p. 385. Peradeniya, Ceylon.

*Cassia auriculata* is a very well-known shrub, occurring gregariously in the low country in the dry districts near the coast of India. The leaves cured and dried furnish " Ranawara Tea ", or " Matara Tea ", which is used medicinally as a blood-purifier, in the cure of diabetes, and also as a laxative. The plant is known popularly as " The Tanner's Cassia ", on account of the large amount of tannin in its bark. The tannin content, however, varies with the age of the shrub, which fact explains the lack of success obtained by the use of a mixture of bark collected indiscriminately from plants of all ages. With bark selected from mature plants, however, a very satisfactory tannage is obtained, especially when it is blended with other tanning materials, such as myrabs (fruits of *Terminalia* spp.). The maximum amount of tannin is extracted at temperatures almost as high as that of boiling water : at 85°-90°C. At these temperatures, MEHD obtained 22 % of tannin.

*Cassia auriculata* flourishes best in deep soils, though it can grow on barren and waste land. It is well worth cultivating as a tanniferous plant ; and is very little trouble, for young plantations only require weeding. One of the large tan factories of Cawnpur has cultivated it to a small extent ; under irrigation, (the annual rainfall being under 40 inches), *Cassia* yields in the 2nd. and 3rd. year, and in the 4th. and 5th. year, if not irrigated.

The writer recommends the cultivation of this plant in Ceylon, in the neighbourhood of tan factories.

- 440 - **Development of Rubber Cultivation in Burma.** — *The Agricultural Journal of India*, Vol. XII, Part. I, pp. 155-156. Calcutta, January, 1917.

The rules regulating grants and assessments of land for rubber cultivation in Burma have been considerably modified. A committee consisting of the Financial Commissioner of Burma and representatives of the Lower Burma Planters' Association drafted these new regulations, which were accepted by the Lieutenant-Governor and duly promulgated. Their recommendations included the following :

Land for rubber cultivation to be granted in perpetuity subject to payment of the annual land revenue assessment and the royalty on the net value of rubber produced and exported ; exemption from land revenue to be granted for the first eight years of occupation ; land revenue and royalty to be levied at the rate of Rs. 3 per acre and 2 per cent respectively for 20 years ; grants to prescribe that one-tenth of the total area granted must be planted with rubber trees within two years of the grant, one-half within four years, and three-fourths within eight years.

The new rules affect only land granted for rubber cultivation on and after July 1st, 1916 : for land granted or leased under previous rules certain abatements of royalty and land revenue assessments are allowed and owners are offered the opportunity of surrendering their land at any time in the next ten years, and of taking out a grant under the new rules.

The following table shows the area under rubber cultivation in Burma and the amount exported in the past five years :

Year	Acres	Lbs.
1911-1912 . . . . .	32 772	310 240
1912-1913 . . . . .	44 029	526 176
1913-1914 . . . . .	50 946	765 072
1914-1915 . . . . .	57 785	987 392
1915-1916 . . . . .	57 843	1 285 984

Experience shows that large areas in Burma are suitable for rubber cultivation, and the committee considers that an estate in full bearing should yield not less than 350 to 400 lb. of rubber per acre.

441 - **The Production of Rubber of Uniform Colour.** — CLAYTON, BEADLE and STEVENS, Report to the Batavian Congress, translated in *Le Caoutchouc et la Gutta-Percha*, Year 13, No. 152, pp. 9032-9033. Paris, October 15, 1916 (1).

In latex there is an oxidase which brings about rapid absorption of the oxygen of the air. Certain organic substances, probably polyphenols, which it contains are thus rapidly oxidised, causing the formation of black matter which colours the rubber.

The surface of a lump of rubber is often black when the interior is not so. When such rubber is placed in the machine the black parts mingle with the pale mass of rubber, and light grey or blue stripes are formed. During the drying process the colour deepens, and the parts which were barely visible when the crepe was fresh show black or brown stripes on a pale yellow ground. Such a rubber is classed as "not uniform" by buyers, who accuse the planters of mixing two qualities of different shades. Colour is not an indication of quality and a variation in this physical property does not imply any variation in the actual quality. Manufacturers nevertheless are suspicious of variations in colour and, when the colour of a rubber is not uniform, its commercial value decreases considerably.

Three methods for obtaining rubber of an equal colour are described :

1ST METHOD : *The use of a large excess of acetic acid in coagulation.* — The latex must be collected rapidly and taken to the factory without delay. It must be coagulated immediately, using a large proportion of acetic acid (1 part titrated as glacial acid for each 300 to 400 parts of latex). The gum should be washed and made into crepe immediately, then dried rapidly by hot air, or better still, in a vacuum drying-room (vacuum bath). An excess of acid is necessary to bring about rapid coagulation and also inhibits the action of the enzyme.

2ND. METHOD : *Boiling the rubber after coagulation.* — This method, which was first practised in Ceylon, consists in boiling the fresh coagulum in order to obtain a pale crepe. The coagulum is cut into pieces the size of a fist, which are then plunged for 10 or 15 minutes into boiling water. The heat destroys the oxidase and the rubber no longer blackens when in contact with the air. Such rubber is pale, but the boiling tends to make it adhesive, and it is more difficult to dry.

3RD. METHOD : *The action of small quantities of antiseptics such as formal and sodium bisulphite before coagulation.* — The antiseptics are added to prevent the action of the enzyme. The ratio between the amount of latex and of the two above mentioned antiseptics is very small, about 1 : 500 to 1 : 1000 or even less. After their action the antiseptics are separated from the rubber when it is washed on the creping machine.

Sodium bisulphite has been said to be a bleaching agent and to damage the rubber. This is incorrect. The rubber does not bleach ; the sodium bisulphite does not destroy colouring matter which has already formed, but prevents it from forming by acting on the ferment. The proportion of bisulphite used is very small as compared with that which is required to destroy a colouring matter which has already formed. It would, moreover, be unsatisfactory to use large amounts of bisulphite, because it gives rise to the same difficulties as does the boiling process after the preparation of the crepe, and would make drying difficult.

Vulcanisation experiments show that the two first methods affect the quality of the rubber ; rubber prepared with an excess of acid is of inferior quality to that prepared with the minimum. The same applies to boiled rubber.

Rubber treated with bisulphite loses none of its good qualities and can hardly be distinguished from untreated rubber.

442 — **Scientific Methods of Tapping *Hevea brasiliensis* in Java.** — DE JONG, A. W. K., in *Mededeelingen van het Agricultuur Chemisch Laboratorium*, No. XIV, pp. 26, fig. 13. Buitenzorg, 1916.

Different methods of tapping were applied to one tree, and it was proved that if tapping is carried out with an interval of one day, the channel made is of insufficient depth. This would appear to account for the fact that the yield obtained by tapping every two days is only half that obtained by daily tapping.

The part of the bark tapped in a previous year has no influence on



tapping carried out next to it, but if this part of the back is immediately under the new incision it will have a marked influence on the yield. Two incisions at the same height 5 cm. apart hardly affect each other. If one of the incisions is made at 1.5 metres and the other at 0.5 metres, there is a distinct effect which becomes more marked if the incisions are not made simultaneously, but at an hour's interval.

These experiments seem to prove that, in *Hevea*, the latex flows in a horizontal as well as in a vertical direction. The horizontal flow is less rapid.

The use of a 15 % salt solution for cleaning the channel has little influence on the flow, and the use of ordinary water none at all.

Experiments made on a number of trees of equal yield showed that the maximum latex flow occurs at 6 o'clock in the morning and not at 10 o'clock.

Further experiments proved that :

- 1) A crooked incision yields as much as a V incision the total length of whose two branches equal that of the crooked incision.
- 2) Two crooked incisions produce about 12 % more than two straight incisions.
- 3) If the incision is renewed at the end of 2 hours the bark is spared and the production increased from 7 to 10 %, but about 4 to 6 % less is obtained than by making two different incisions in one day.

443 - The Production of "Damar" Resin in the Batjan Sultante, Moluccas. — KORN, V. E., in *Tydschrift voor het Binnenlandsch Bestuur*, Vol. 51, Pt. 4, pp. 277-294. Batavia, 1916.

The Batjan Sultanate, which is bound by contract to the Government of the Dutch Indies, includes islands situated right in the east of the Indian Archipelago. In these islands are found trees which, either by natural secretion, or after preliminary treatment, yield the "damar" resin used in Europe in the manufacture of varnish. This "damar-poetih" or "damar-radjah" is secreted by trees of the *Agathis loranthifolia* Salisb. species. These nearly always form forests of a fairly wide area. Another variety, the "damar-radjak", is produced by *Vatica moluccana* L. (Dipterocarpaceae). A 3rd. variety of commercial value is the "damar matakoetjing", produced by another species of the same family as yet undetermined. The natives also collect other resins in this district, but they are chiefly of local value and used in the manufacture of torches. All these trees exude "damar" naturally. Sometimes even it is found buried in the soil, where it has collected from trees which have disappeared.

Only the *Agathis* is treated artificially to stimulate the secretion of resin. The natives make an incision of 30 cm. at man's height, then another 60 cm. higher, and others the same distance apart. Care is taken only to cut half of the bark, leaving the rest intact. The "damar" flows slowly from the incisions and, after some months, large balls of yellow, very clear resin form. The "damar" thus collected has a greater value than that scraped from the bark, in which are always found bits of the bark and other impurities. After the resin has been collected the wounds are cleaned and scraped, and, after 1 ½ months, there is a new flow.

The process is repeated annually. Sometimes, however, the natives cut down the tree so as to have a single more abundant harvest. This has led to the devastation of the forests, and the Government is using all the means in its power to stop a custom which, in a few year's time, would totally destroy all produce. Measures have been taken to preserve the full-grown trees and to replant the devastated forests.

The natives transport the "damar" to the coast, where traders sort it according to colour, purity and transparency. It is further divided into hard and soft resins and large pieces. Thus sorted, it is packed in bamboo baskets covered with cotton sacking.

## SUGAR CROPS

444 - **Influence of Manganese on the Nitrogen Content of Sugar Beets; Experiments in Germany.** — ULRICH, K., in *Blätter für Rübenbau*, Year 24, N° 3, pp. 31-33. Berlin, February 15, 1917.

An experimental field was prepared in the usual way, except that it received no preparatory manuring. It was divided into 4 plots which afterwards received the following quantities of fertiliser per hectare :

Plot 1. . . . .	150 kg. of manganese sulphate + 200 kg. aluminium sulphate.
Plot 2. . . . .	150 kg. of manganese peroxide.
Plot 3. . . . .	48 kg. of manganese phosphate.
Plot 4. . . . .	No manure.

The preceding crop was autumn wheat. The fertilising expenses were fairly high, viz. 191.5 marks (1) per hectare for the 1st plot, 270 marks, for the 2nd., and 432 marks for the 3rd.

If such manuring is to be worth while it should result in a considerable increase in the crop. The writer gave these amounts as they had given excellent results in a previous experiment. It is his intention to repeat the experiments later on with smaller amounts.

Sowing was carried out on the 28th. April, 1916, and thinning on the 6th. May following. The seed used was "Klein-Wanzlebener Original". During the growth period the rainfall was 235 mm. For various reasons the crop was lifted on the 29th. September when the beets fertilised with manganese were still at the height of their development. Those treated with manganese phosphate remained somewhat sick and gave the impression of having been poisoned by the large quantities of manganese. In all three cases, the manganese seemed to favour the leaf development and so retarded the beets coming to maturity.

Table I gives the yield of the roots in sugar.

TABLE I. — *Yield of roots and sugar.*

	Roots per hectare	Sugar content	Sugar per hectare
Plot 1. . . . .	31 000 kg.	15.6 %	4 800 kg.
Plot 2. . . . .	30 000	15.7	4 730
Plot 3. . . . .	23 800	16.0	3 800
Plot 4. . . . .	26 800	16.2	4 348

(1) For the purpose of this article 1 Mark may be regarded as equal to a shilling. (Ed.)

The chemical analysis of the roots and leaves is given in Table II. It shows that the manuring with manganese has markedly increased the total nitrogen content, the ammoniacal nitrogen and amides, but not the protein nitrogen.

CONCLUSIONS. — 1) Manganese sulphate at the rate of 150 kg. per hectare in company with aluminium sulphate does not poison the beets but retards their coming to maturity.

2) Manganese peroxide is not toxic when employed by itself at the rate of 150 kg. per hectare.

3) Manganese phosphate employed alone at the rate of 48 kg. per hectare has exhibited a toxic effect.

TABLE II. — *Percentage Analysis of Roots and Leaves.*

Plots and fertiliser	Dry matter		Ash		Polarisation (writer's own method)	Total Nitrogen		Protein		Ammo- niacal nitrogen and amides		Injurious nitrogen		Total invert Sugar
	Roots	Leaves	Roots	Leaves		Roots	Leaves	Roots	Leaves	Roots	Leaves	Roots	Leaves	Leaves
1) Manganese sulphate + aluminium sulphate	21.81	9.29	0.737	2.28	15.6	0.175	0.203	0.080	0.105	0.019	0.015	0.076	0.083	1.33
2) Manganese peroxide . . . . .	22.05	9.52	0.711	2.23	15.7	0.151	0.206	0.070	0.115	0.020	0.012	0.061	0.079	1.48
3) Manganese phosphate . . . . .	22.21	9.61	0.712	2.34	16.0	0.174	0.182	0.078	0.110	0.017	0.009	0.079	0.063	1.72
4) Without manure . . . . .	22.40	9.26	0.666	2.47	16.2	0.161	0.172	0.076	0.103	0.012	0.007	0.073	0.062	1.38

445 - Experiments on the Cultivation of Mild Yellow Tobaccos in Tripoli. — MAZZOCCHI-ALEMANNI, NALLO (of the Royal Agricultural Office of Tripoli), in *Ministero delle Colonie, Ufficio economico, Bollettino di Informazioni*, Year IV, No. 7-9, pp. 302-348, 13 fig. Rome, July-September, 1916.

These experiments were carried out in the oasis of Tripoli with the following varieties of tobacco: Turkish, "Virginia Bright", Java. The seeds were obtained from the Scafati Tobacco Experimental Institute, in the province of Salerno, and from the Tobacco Agency of Lecce (Apulia). The experiments for each variety included those on:

1) *Sowing*

- The most favourable season
- The best type of soil
- The best methods for combating unfavourable environmental conditions.

2) *Cultivation*

- Manuring
- Treatment of the soil
- Special cultural methods.

STIMULANT,  
AROMATIC,  
NARCOTIC,  
AND MEDICINAL  
PLANTS



3) *The best methods for treating the products (curing and drying).*

The following conclusions were reached :

1) *Sowing technique* : Sowing should be carried out in soils with a southern exposure, protected from winds from the 1st. and 4th. quadrants, in a semi-cold bed, with as early seeds as possible.

2) *Preparation of the Soil* : A couple of ploughings or hoeing in winter ; manure made up of 6 tons of dung and from 4 to 4  $\frac{3}{4}$  cwt. of wood-ash per acre ; usual treatment of the soil in spring.

3) *Transplanting* : This should be carried out when the plants are from 12 to 15 cm. high.

4) *Cultivation Methods* : Irrigation ; tillage ; hoeing ; hilling up, screening against wind ; topping (for the Samsun and Porsucian varieties only) ; removal of buds.

5) *Harvesting*.

6) *Curing and drying of the leaves*.

The yields (in dried leaves) obtained are given in the following table :

*Results of Experiments in the Cultivation of Tobacco in the Oasis of Tripoli.*

Varieties	Yield in leaves per acre	Classes (approximate percentages)			
		1st and 2nd.	3rd	4th	Waste
Sansum . . . . .	1026 lbs.	42 %	30 %	13 %	about 12 $\frac{0}{10}$
Herzegovina . . . . .	2980	29	46	15	
Virginia . . . . .	2498	85	10	—	
Xanti . . . . .	830	86	10	—	
Aya . . . . .	928	78	12	—	
Porsucian . . . . .	820	72	15	—	
Sansum 2. . . . .	1365	60	25	—	3
Java . . . . .	1338	85			

Further experiments were made in 6 native tobacco fields, amongst which Samsun plants were distributed. They yielded from 12 to 20 leaves per plant.

446 - **The Manuring of Tobacco Nurseries in Java.** — ULTEE, A. J., in *Mededeeling van het Besoekisch Proefstation*, No. 23, pp. 11-20. Soerabaja, 1916.

On the Besoeki estate (east of Java), the tobacco nurseries are situated almost exclusively on unirrigated soil. A great part of the richness of these soils is lost by continual cultivation and must be replaced by either a green or a chemical manure.

With regard to *green manures*, experiments made with a species of *Dolichos* and *Crotalaria striata* show the difficulty of burying these plants to a sufficient depth. The leaves of the plants also appear to shelter insects harmful to tobacco, such as *Opatrum depressum*. The use of *Centrosema*

*Plumieri* is advised as it appears to be more resistant to the great drought of these countries. Attention is also drawn to *Desmodium gyroides* and *Canavalia ensiformis*, plants which should give good results on account of their rapid growth.

So far as *chemical manures* are concerned, experiments showed the favourable action of a fertiliser composed of 60 gr. of ammonium sulphate + 20 gr. of double superphosphate, which was used over an area of about 6 square yards of the nursery.

447 — **The Cultivation of *Chenopodium Quinoa* in Germany.** — ZEELE, in *Deutsche Schlacht- und Viehhof-Zeitung*, Year 17, No. 10, pp. 74-75. Berlin, March 7, 1917.

HORTICULTURE

*Chenopodium Quinoa* (1) has been imported from South America into Germany, where it is now cultivated. This annual (cultivated in the Cordilleras up to a height of 10 000 feet) develops in 4 months. It is remarkable for its high yield of seeds, which contain about 23 % of albuminoids and about 57 % of N. free extract. These seeds may be used either for bread-making or as a food for cattle and poultry. The green parts of the plant may be prepared and used as a vegetable in a similar way to spinach.

Cultivation experiments carried out in Germany show that *Chenopodium quinoa* grows very well there. In 1916, the "Kriegsernährungsamt" (Department for the distribution of food during the war) bought the greater part of the harvest so as to prevent the use of good seed as food.

Sowing is carried out at the end of April in cold beds. To ensure a good harvest sowing should be thin and care should be taken that the seeds be not covered with too thick a layer of soil which would prevent their germinating. The plants are thinned between the 20th. and 30th. May, then planted in the open sufficiently far apart to ensure sufficient air and light. Under these conditions they may reach a height of 6 ½ ft. or more. A field of 2 ½ acres requires 7 oz. of seed. The unit yield in seed of *C. Quinoa* about corresponds to that of the cereals cultivated in Germany.

448 — **Statistics of Fruits in the Principal Countries.** — RUDDIMANN, H. D., in *United States Department of Agriculture, Bulletin*, No. 483, 40 pp. Washington, D. C., February 14, 1917.

FRUIT  
GROWING

The above-mentioned bulletin presents in a concise form statistics of fruit and fruit products (oil, wine) in the principal producing, exporting and consuming countries. The figures used have been taken from official sources, usually from publications of the countries treated. The data concerning the fruit trade are as a rule fairly complete, those relating to production on the other hand, are in many instances either fragmentary, or limited to census years.

The statistics, for the most part, deal with the period which has elapsed between 1909 and the present day. The data refer to the following countries, fruits, and fruit products:

*United States*: Apples — Peaches and Nectarines — Plums and Prunes — Pears — Cherries — Citrus Fruits — Figs — Pineapples — Olives —

(1) See also: *B.* 1914, No. 428. — *B.* 1916, No. 59.

(Ed.)

Grapes — Strawberries — Raspberries and Loganberries — Canned Fruits — Dried Fruits — Wines — Cider — Vinegar.

Canada, Central America, British West Indies, Cuba, Dominican Republic, Paraguay, Uruguay, Austria-Hungary, Belgium, Netherlands, Denmark, Norway, Sweden, France : Olives — Peaches — Apricots — Apples and Pears for table use and for cider and perry-making — Cherries — Prunes — Wines.

Germany : Apples — Pears — Plums — Cherries — Apricots — Peaches — Wines.

Italy : Grapes and Wines — Olives and Oil — Other Fruits.

Russia, Bulgaria, Greece, Crete, Rumania, Serbia, Turkey, Spain, Portugal, United Kingdom, Japan, Persia, Algeria, Tunis, South African Union, Australia, New Zealand, Hawaii.

449 - Little Known Brazilian Fruits which are of Interest to Fruit Growers. — DORSETT, P. H., SHAMEL, A. D., and POPENHOE WILSON in *United States Department of Agriculture, Bulletin No. 445*, 35 pp. 1 fig. + XXIV Plates. Washington, February 10, 1917.

Observations made during a botanical expedition of which the purpose was the special study of the navel orange in the province of Bahia, where this variety is indigenous (1).

Amongst the most interesting fruits grown in Bahia in the neighbourhood of Rio Janeiro, on the plateaus and the szemi-arid regions of Minas-Geraes and Bahia, the writers record :

#### I. — BAHIA.

##### 1) CULTIVATED FRUITS :

*Tamarindus indica* — “Carambola” (*Averrhoa Carambola* L.) — “Groselha” (*Phyllanthus acida* [L.] Skeels) — “Abacate” (*Persea americana* Mill.) — “Caja” (*Spondias lutea* L.) — *Caja manga* (*S. cytherea* Sonnerat) — “Sapoti” (*Achras sapota* L.) — “Maracujá's” (*Passiflora* spp.) — “Jambo” (*Caryophyllus Jambos* [L.] Stokes). — “Mamac” (*Carica papaya* L.) — “Guava” (*Psidium Guajava* L.) — “Araça do Rio” and “Araça cagão” (*Psidium* spp.) — “Abacaxi” or “Ananasso” fruits justly prized for their flavour — “Jácea” (*Artocarpus integra* [Thumb] L. f.) — “Fruta de pão” (*Artocarpus communis* L.) — “Fruta de Conde” (*Anona squamosa* L.) — “Araticum” (*Anona Salzmanni* A. D. C.).

2) WILD FRUITS ESPECIALLY INTERESTING TO FRUIT GROWERS. “Grunixana” or “Grunichana” (*Eugenia Dombeyi* [Spreng] Skeels) = *Eugenia brasiliensis* Lam. — “Pitomba” (*Eugenia Hiscnathiana* Berg) — “Genipapo” (*Genipa americana* L.) — “Gravatá” (*Bromelia* sp.) — “Abiu” (*Ponteria Caimito* [R. and P.] Radlk.) — “Pitanga” (*Eugenia uniflora*) — “Cashew” or “Cajú” (*Anacardium occidentale* L.) — “Mango” (*Mangifera indica* L.) — Dendê (*Elaeis guineensis* Jacq.).

#### II. — RIO JANEIRO AND NEIGHBOURHOOD.

##### CULTIVATED FRUITS :

“Jaboticaba” (*Myrciaria cauliflora*, *M. trunciflora* *M. Jaboticaba* — “Cabelluda” (*Eugenia Phylloclalyx* [tomentosa] Cambess.) — “Guabiroba” (*Campomanesia Fenzliana* [Berg.] Glaziov) — “Cambria” *Myrciaria plicato-costata* Berg. = *M. edulis* [Weil] Skels. — “Bacupari” (*Rheedia brasiliensis* Planch. and Triana) — “Frutta di condessa” (*Rollinia deliciosa* Safford)

#### III. — PLATEAUX AND SEMI-ARID REGIONS OF MINAS-GERAES AND BAHIA.

Wild fruits (some cultivated).

“Pera do campo” or “Cabacinba do campo” (*Eugenia Klotzschiana* Berg.) — “Limão do matto” (*Rheedia edulis* Planch. and Triana) — “Pinha” (*Anona squamosa* L.) — “Araticum do brejo” (*Anona spinescens* Mart.) — “Imbú” (*Spondias tuberosa* Arruda) especially interesting as a drought resistant plant — “Jvazeiro” or “Juazeiro” (*Zizyphus Joazeiro* Mart.).

(1) See B. January 1916, No. 67.

(Ed.).



450 - Apples; Production Estimates and Important Commercial Districts and Varieties. — GOULD, H. P. and ANDREWS, F., in *United States Department of Agriculture, Bulletin*, No. 485, pp. 1-48. Washington, D. C., January 20, 1917.

From a study, made in 1910, of nursery catalogues issued for that year, it appeared that the nurserymen of the United States were then offering to the trade trees of at least 500 different varieties of apples. Since that date there has been a decrease rather than an increase in the varieties cultivated, and their number is relatively small.

The chief aim of the statistics contained in this paper is to determine the relative distribution of the principal varieties of apples cultivated in the United States. Table I gives data showing the actual production and the relative percentage to the entire crop of the 35 chief varieties grown.

TABLE I. — *Estimated average production of 35 of the most important varieties of apples, showing the percentage relation of each variety to the entire crop, for the years 1909 to 1913 inclusive.*

Varieties	Production in Barrels	Relation to total crop Percentage
White Permain (White Winter Permain) . . . . .	269 000	0.5 %
Arkansas (Mammoth Black Twig) . . . . .	393 000	0.7
Missouri (Missouri Pippin) . . . . .	499 000	0.8
Wolf River . . . . .	503 000	0.9
Arkansas Black . . . . .	526 000	0.9
MacIntosh (MacIntosh Red) . . . . .	530 000	0.9
Horse (Yellow Horse) . . . . .	545 000	0.9
Northwestern . . . . .	553 000	0.9
Tolman (Tolman Sweet) . . . . .	592 000	1.0
Gravenstein . . . . .	619 000	1.1
Fameuse (Snow) . . . . .	775 000	1.3
Tompkins King (King of Tompkins County) . . . . .	797 000	1.4
Golden Russet . . . . .	830 000	1.4
Yellow Bellflower . . . . .	845 000	1.4
Yellow Transparent . . . . .	893 000	1.5
Stayman Winesap . . . . .	907 000	1.5
Red June (Carolina Red June) . . . . .	914 000	1.6
Lambertwig (Red Lambertwig) . . . . .	915 000	1.6
Gano . . . . .	927 000	1.6
Yellow Newtown (Albemarle; Newtown Pippin) . . . . .	968 000	1.6
Fall Pippin . . . . .	988 000	1.7
Oldenburg (Duchess of Oldenburg) . . . . .	1 097 000	1.9
Red Astrachan . . . . .	1 120 000	1.9
Maiden Blush . . . . .	1 203 000	2.0
York Imperial (Johnson Fine Winter) . . . . .	1 262 000	2.1
Grimes (Grimes Golden) . . . . .	1 294 000	2.2
Wealthy . . . . .	1 322 000	2.2
Early Harvest (Prince's Harvest) . . . . .	1 641 000	2.8
Rome Beauty . . . . .	1 813 000	3.1
Jonathan . . . . .	2 135 000	3.6
Rhode Island Greening (Greening) . . . . .	2 767 000	4.7
Winesap . . . . .	3 012 000	5.1
Northern Spy . . . . .	3 570 000	6.1
Ben Davis . . . . .	7 833 000	13.3
Baldwin . . . . .	7 861 000	13.4
Other varieties . . . . .	6 109 000	10.4
Total . . . . .	58 827 000	100.0

It is seen that the two varieties Ben Davis and Baldwin represent 26.7 % of the total production, and 8 varieties represent more than 50 %. The geographical distribution among the States of these 8 varieties is given in Table II.

TABLE II. — *Distribution among the States of the 8 leading varieties.*

<i>Baldwin</i>	Production in bushels	<i>Winesap</i>	Production in bushels
New York . . . . .	9 071 000	Virginia . . . . .	1 888 000
Pennsylvania . . . . .	2 351 000	Kentucky . . . . .	988 000
Michigan . . . . .	1 868 000	Missouri . . . . .	765 000
Maine . . . . .	1 545 000	Tennessee . . . . .	720 000
Ohio . . . . .	1 394 000	North Carolina . . . . .	639 000
Massachusetts . . . . .	1 360 000	Kansas . . . . .	605 000
Connecticut . . . . .	805 000	Other States . . . . .	3 431 000
New-Hampshire . . . . .	780 000		
New-Jersey . . . . .	504 000	<i>Jonathan</i>	
Other States . . . . .	3 905 000	Missouri . . . . .	1 170 000
		Washington . . . . .	733 000
<i>Northern Spy</i>		Kansas . . . . .	545 000
New York . . . . .	3 797 000	Illinois . . . . .	530 000
Michigan . . . . .	1 966 000	Colorado . . . . .	518 000
Pennsylvania . . . . .	1 506 000	Iowa . . . . .	516 000
Ohio . . . . .	688 000	Other States . . . . .	2 393 000
Other States . . . . .	2 754 000		
		<i>Rhode Island Greening</i>	
<i>Ben Davis</i>		New York . . . . .	4 289 000
Missouri . . . . .	3 849 000	Pennsylvania . . . . .	727 000
Illinois . . . . .	2 154 000	Michigan . . . . .	593 000
Arkansas . . . . .	1 508 000	Ohio . . . . .	509 000
New York . . . . .	1 449 000	Other States . . . . .	2 182 000
Indiana . . . . .	1 248 000		
Ohio . . . . .	1 242 000	<i>Rome Beauty</i>	
Kentucky . . . . .	1 185 000	West Virginia . . . . .	1 138 000
Virginia . . . . .	1 040 000	Ohio . . . . .	965 000
West Virginia . . . . .	955 000	Kentucky . . . . .	677 000
Michigan . . . . .	934 000	Washington . . . . .	648 000
Pennsylvania . . . . .	793 000	Other States . . . . .	2 011 000
Kansas . . . . .	766 000		
Iowa . . . . .	761 000	<i>Wealthy</i>	
Colorado . . . . .	745 000	Iowa . . . . .	621 000
Tennessee . . . . .	623 000	New York . . . . .	522 000
Nebraska . . . . .	572 000	Other States . . . . .	2 824 000
Other States . . . . .	3 675 000		

The statistics given also include the distribution in each State of the 35 above mentioned varieties, and the distribution of early and late varieties and their respective production.

451 - **On the Growth of the Fig Tree in Arizona, U. S. A.** — LAWRENCE, W. H., in *University of Arizona, Agricultural Experiment Station, Bulletin No. 77*, 43 pp., 14 fig. + plates. Tucson Arizona, June 1, 1916.

This Bulletin contains the collected results of a general inspection of the fig-tree plantations in Arizona, carried out by the writer, both personally and by letter. The writer wished to: 1) determine the general distribution in the State; 2) find the healthy forms that have given the best results for ten years or so after planting; 3) determine the number of groups represented in the State, as well as the necessary cultural methods.

The results are also given of three years' study on 60 trees representing 43 kinds belonging to 5 botanical varieties, a work carried out in order to determine the best varieties from the point of view of the production of more uniform and abundant fruit.

In 1910, there were 3848 fig trees in bearing which gave a total crop of 57 643 kg. (being equal to about 15 kg. per tree) and 47 208 trees not yet in bearing. Practically the whole number is to be found in Maricopa county. The production varies greatly, being from 0.82 to 130 kg. per tree.

Of the 43 kinds studied, those that were the best as regards development were: Black Smyrna, Lot Injir, Bellona, Bulletin Smyrna. The following were healthy and good croppers: Mission, Lot Injir, Bulletin Smyrna, White Adriatic, Black Smyrna.

The 43 kinds belong to the following five botanical varieties:

- 1) Capri (*Ficus Carica* var. *syvestris*).
- 2) Smyrna (*F. Carica* var. *smyrnica*).
- 3) San Pedro (*F. Carica* var. *intermedia*).
- 4) Comune or Adriatica (*F. Carica* var. *hortensis*).
- 5) Cordelia (*F. Carica* var. *relicta*).

452 - **The Yield of Unpruned Vines.** — DALMASSO, G., in *La Rivista di Viticoltura, Enologia ed Agraria*, Year 23, No. 4, pp. 49-50. Conegliano, February 15, 1917. — II. RAVAZ, L., in *Le Progrès agricole et viticole*, Year 34, Vol. LXVII, N° 10, pp. 221-224, Montpellier, March 11, 1917.

VINE GROWING.

I. — M. DALMASSO has noticed that, in the vineyards of the Conegliano Wine Growing School, the unpruned vine-plants gave better yields than those that had been pruned. He further mentions the fact that M. RAVAZ had previously recorded the same phenomenon as having occurred in a vineyard of the National School of Agriculture at Montpellier, where Aramon vines unpruned for 10 years still continued to give a yield quite comparable to that of pruned vines.

The results of the experiments at Conegliano are summarised in the following Table.

	Riesling Italicco vines	Production per vine-plant	Composition of the must		Maturation Index
			Sugar	Acidity	
1915 .	Pruned . . . . .	0.93 kg.	20.25 %	5.62 ‰	3.60
	Unpruned . . . . .	1.80	20.60	6.93	2.97
1916 .	Pruned . . . . .	0.90	18.20	6.19	2.94
	Unpruned . . . . .	1.29	17.50	5.81	3.01



According to the author, it can be assumed that the time within which pruning may be neglected is not long, since, in 1916 (as shown by the above Table), the difference in favour of the unpruned vines is still less than in 1915. This makes it probable that the fertility of the fruit buds is, beyond a certain limit, inversely proportional to their number.

There is no danger in neglecting to prune in winter for one or two years.

II. — M. RAVAZ quotes the experiments of M. DALMASSO, compares them with his own and then adds some personal conclusions which complete those of the latter author.

It should be remembered that as pruning is done to reduce the yield of the plants so that the quantity produced has a certain value, it is, therefore, more necessary in regions producing wines with high alcohol content than in those producing ordinary wines. If the "Pinots" of Champagne and Burgundy, the "Chenins" of the Loire, the "Cabernets", "Merlots" and "Malbecs" of the Gironde, the "Carignans" and "Grenaches" of Roussillon, the "Muscats" of Lunel and Frontignan, etc., were not pruned, there would be a large crop of rather small grapes with small seeds and which would not easily ripen, thus producing but a mediocre wine.

Where varieties with large grapes and seeds are grown, the reduction of the number of grapes by pruning is in some measure compensated for by the individual increase in size. Thus, there is not the same difference in yield, and consequently in quality, between pruned and unpruned vines as in the preceding cases. This is what took place with the Aramon variety which the writer used for his observations.

There is no reason to believe that it is fatal if pruning is not carried out (as has frequently happened during the war), especially in regions producing ordinary wines; it even presents an advantage as giving easier defence against mildew, which is all the less dangerous when attacking more slowly growing branches.

453 - Stocks Tested at the National School of Agriculture, Montpellier, France. — RAVAZ, L., in *Le Progrès agricole et viticole*, Year 34, No. 8, pp. 176-178. Montpellier, February 25, 1917.

An experimental field was planted with stocks 16 years ago at the National School of Agriculture at Montpellier. The soil contained 25 to 34 per cent. of calcium carbonate, but it was only slightly liable to cause chlorosis. Riparia did not do very well there, but it did not succumb to chlorosis. It was pulled up some years ago, as well as certain other varieties, in order to make room for new plantations.

7605, 4206 are Riparia-Berlandieris, with satisfactory foliage; 301, 17-37, 7821, 219-A, 20031, 20035 are Rupestris-Berlandieris whose foliage is, on the whole, better than the previous ones. 17-37, which is well liked in Sicily, does finely.

*Average weight (in kg) of branches per stock of various grafting varieties.*

Stocks	Aramon	Servant vert	Dattier	Muscats de Hambourg	Muscats d'Alexandrie	Servant rond	Gros Colmar	Vulency blanc
PLOT I.—SIDE A.								
7605 . . . . .	0.700	0.850	0.800	1.425	0.825	1.250	1.700	—
301 A . . . . .	1.025	0.775	1.050	1.050	0.700	1.050	1.700	—
301-4-153 . . . . .	1.100	0.850	1.325	1.100	0.825	1.500	1.250	—
301-4-152 . . . . .	0.450	0.425	1.450	0.575	0.325	1.200	1.250	—
17-37 . . . . .	1.400	0.975	0.725	0.600	0.875	0.800	1.550	—
7821 . . . . .	0.650	0.650	0.450	0.550	0.500	0.950	1.400	—
20029 . . . . .	1.125	0.550	1.050	0.600	0.325	1.300	1.150	—
Berlandieri Gigantesque N° 2 . . . . .	0.700	0.650	1.025	0.550	0.475	1.000	0.850	—
Berlandieri Gigantesque N° 19 . . . . .	0.650	0.975	0.600	0.800	0.500	1.000	1.450	—
Berlandieri Gigantesque N° 20 . . . . .	1.175	0.600	1.100	0.750	0.400	—	0.950	—
Pukwana . . . . .	0.500	0.900	0.750	0.625	0.450	0.750	0.950	—
548-1 . . . . .	0.850	0.500	0.350	0.350	0.325	—	0.750	—
18804 . . . . .	1.400	1.050	1.525	1.125	0.600	0.450	1.100	—
18-815 . . . . .	0.650	0.750	1.550	0.800	0.425	1.100	1.000	—
Colorado Jardin . . . . .	0.550	0.600	0.800	0.825	0.475	0.750	0.750	—
Cordifolia Rupestris . . . . .	1.050	0.600	0.550	0.750	—	0.250	1.200	—
107-11 . . . . .	0.500	0.775	1.025	0.800	0.900	0.650	0.250	—
Cordifolia Rupestris Jardin . . . . .	0.725	0.590	0.650	0.725	0.500	0.200	0.650	—
106-8 . . . . .	0.525	0.580	1.000	0.550	0.650	0.900	1.600	—
11 F . . . . .	0.775	0.500	0.600	0.550	0.400	—	0.250	—
3309 . . . . .	1.050	1.400	0.350	0.825	0.475	1.100	1.150	—
Riparia Rupestris B . . . . .	0.700	0.600	0.900	0.375	0.425	—	0.800	—
Jacquez . . . . .	0.300	0.600	1.050	0.550	0.300	0.200	0.300	—
41 B . . . . .	1.425	0.915	0.800	1.150	1.200	1.100	0.300	—
Aramon Rupestris Berlandieri 9 . . . . .	0.500	—	—	0.650	0.900	—	0.700	—
Aramon Rupestris Berlandieri 15 . . . . .	1.075	1.000	1.400	0.750	0.225	0.200	1.300	—
PLOT I.—SIDE B.								
Berlandieri × Riparia . . . . .	0.475	0.850	0.825	0.400	0.250	1.100	1.350	1.100
301-C . . . . .	0.600	0.625	0.625	1.200	0.100	0.700	0.250	1.250
301-37-152 . . . . .	0.525	0.825	1.050	0.900	0.650	0.750	0.600	—
219-A . . . . .	1.125	1.075	0.950	0.600	1.000	0.550	0.400	1.450
420-C . . . . .	0.825	—	0.500	1.000	0.325	0.550	1.400	0.800
20031 . . . . .	0.875	0.800	0.600	0.600	0.375	1.050	1.250	0.500
20035 . . . . .	1.300	0.575	1.250	0.700	1.000	1.000	—	0.900
Berlandieri Gigantesque N° 5 . . . . .	0.675	0.800	—	1.350	0.400	—	0.650	1.100
Berlandieri Gigantesque N° 18 . . . . .	1.500	0.850	1.650	0.450	0.975	—	—	1.300
2 R <sub>2</sub> . . . . .	0.700	0.575	—	—	0.700	0.350	0.400	—
554-5 . . . . .	0.900	1.200	1.650	0.600	0.375	0.700	1.500	1.300
1 R . . . . .	—	0.550	0.300	1.200	0.500	0.700	1.000	—
18808 . . . . .	1.025	1.100	0.300	0.650	0.525	0.600	1.600	—
6831 . . . . .	0.550	0.675	0.475	—	0.300	0.500	—	0.800
X . . . . .	1.500	0.675	0.525	—	0.500	—	0.750	0.800
Taylor Narbonne . . . . .	1.050	0.750	0.525	—	0.200	0.450	0.650	1.150
Riparia Indien . . . . .	—	1.000	0.700	0.450	0.500	0.750	0.350	0.850
125-1 . . . . .	1.025	1.000	1.250	0.700	0.750	0.450	—	0.800
101-14 . . . . .	0.950	1.200	0.550	0.850	0.250	0.300	0.900	—
3306 . . . . .	1.250	0.650	1.225	1.400	1.000	0.400	0.800	0.750
3001 . . . . .	1.325	1.700	1.600	0.450	0.350	—	1.700	—
Gigantesque . . . . .	1.000	0.850	0.525	—	0.450	0.250	1.100	0.950
Herbemont . . . . .	0.500	0.500	—	—	—	—	—	—
333 . . . . .	1.500	0.550	0.100	0.550	0.675	—	—	0.850
(Aramon × Rupestris) Berlandieri N° 13 . . . . .	0.800	0.550	1.150	0.650	1.200	1.200	0.950	1.000
17805 . . . . .	0.850	1.100	—	0.600	0.900	—	1.250	—

It is one of the best crosses in this group. It also seems to be drought-resistant, at any rate in Sicily. Unfortunately, it is difficult to propagate by cuttings. 219-A and 20029 have more or less come up to expectation. All these numbers are derived from a cross between *Vinifera-Berlandieri* and a *Rupestris*; they are probably inferior, at least as regards strength and resistance to chlorosis, to the new varieties produced from *Rupestris du Lot*.

There is nothing to remark about the *Berlandieri* × *Gigantesque* Nos. 2, 19, 20, 5, and 18.

In the following group, up to and including Colorado-Jardin and 6831, which is more or less related to *V.-Monticola*, the only number worth notice is 18 804. In that vine, *Riparia* dominates, and *Monticola* shows up very little. All the same it is vigorous and is worth testing on a large scale. 1-R. and 2-R., very pure *Riparia-Monticolas* were obtained by the writer; they do not show up very well because of the bramble-leaf disease. But elsewhere, in a more chlorotic calcareous soil, they are clearly more resistant to chlorosis than 420-A. The writer thinks that crosses of *Rupestris du Lot* and *V.-Monticola* would be better than *Rupestris-Berlandieri*. But these new hybrids are not obtainable commercially.

*Cordifolia-Rupestris*, 107-II, Taylor-Narbonne, Rip.-T.-Indien, 125-I, are rather weak, partly because they are very sensitive to lime. Taylor-Narbonne and 11-F are weakened by phylloxera.

In the *Riparia-Rupestris* group, 3 306, 3 309, and 3 901, hold the best place; 101-14 is much weaker. Herbemont and Jacquez are very feeble because of the phylloxera.

333 and 41-B, *Vinifera-Berlandieri* hybrids, are both very good, and have not suffered from phylloxera. These two vines might be suspected on account of their origin, but continued experiments show they are all right. In comparative pot tests of phylloxera resistance, 41-B was always resistant, and 333 less so. In the open field, both seemed equally resistant. They can therefore be used in all vineyards where they are required because of calcareous soil.

The Aramons-*Rupestris-Berlandieri* of MALÈGUE are  $\frac{1}{2}$  *Berlandieri* and  $\frac{1}{4}$  *Vinifera*. They should be sufficiently resistant to phylloxera. In the above-mentioned tests, they were slightly affected by phylloxera, as they had superficial lesions. In the experimental field their roots were healthy and the foliage of one of them, No. 15, or 150-15, was very satisfactory.

454 - *Pinus ponderosa* Laws in Oregon, United States. — MUNGER, THORNTON, T., in *United States Department of Agriculture, Bulletin*, No. 418, 48 pp. Washington, D. C. February 6, 1917.

*Pinus ponderosa* Laws is known throughout its range simply as pine, or yellow pine, and in the lumber trade of the northwest, as western pine. It is sometimes called western soft pine, or more rarely, Oregon white pine. In California, it is commonly termed western white pine, and Californian white pine.

This conifer is the most widely distributed pine in the United States,



occurring in 12 States, and is one of the most valuable trees. In Oregon, *P. ponderosa* occurs on about 14 000 000 acres, the estimated stand amounting to 70 000 000 000 ft.

The altitudes at which it is found, range from the lowest zone of forest growth up to 6000 ft. on the slopes of the mountains; scattered individual trees even growing as high as 8000 ft. It flourishes best in the heat and dryness of a continental climate. In the north, or on the highest slopes, its development is poorer than where the summers are long and warm. This pine forms splendid forests where the precipitation is only 18 inches a year; it also does well where the rainfall is much heavier — 40 inches or more — but its development is by no means proportionately better in the wetter climates: it prefers well-drained soils.

*Pinus ponderosa* is a large well-formed timber tree with a straight bole and round crown. It is well cleared of dead branches, but usually clothed with live branches from  $\frac{1}{2}$  to  $\frac{2}{3}$  its height. The foliage is not extremely heavy; the needles, which are borne in clusters of 3, are usually from 4 to 6 inches long; on the best soils, they attain the length of 11 inches.

This tree is intolerant of shade; seedlings do fairly well under the shade of parent-trees, but saplings do not grow thriftily until they receive direct light.

*Pinus ponderosa* rarely produces any cones before it is 50 years old, and large crops are not borne except by very much older trees. Every three years and sometimes oftener, come good seed years. The number of seeds to the pound is between 8 000 and 9 000; one bushel of cones will yield 1  $\frac{1}{2}$  lbs. of seed. The seed germinates fairly freely, but the mortality of the seedlings is high (79 per cent); hardly one tree in a hundred lives to be 2 years old.

The tree grows slowly till it is 20 or 30 years old; at 6 years of age, it is never more than 1 ft. high; when 20 years old, it attains the height of 4 ft. Only those seedlings ultimately survive which grow between clumps of old trees, or beneath those that have recently died. Cold, drought, fires and grazing sheep are the principal causes of the destruction of the young seedlings.

As the chief enemies of *Pinus ponderosa* the writer mentions the "pine butterfly" (*Neophasia menapia*), feeding upon the needles — the "western pine destroyer" (*Dendroctonus brevicornis*) — and the "mountain pine beetle" (*Dendroctonus monticolae*); these two latter insects kill a large number of pines.

Of the vegetable parasites, the following may be named: *Razoumojskya campylopoda* a kind of mistletoe, which impairs the tree's value for commercial purposes, — *Peridermium filamentosum*, a rust attacking young growth — 2 lichens, *Alectoria tremontii*, "black moss", and *Evernia vulpina*. — *Polyporus schweinitzii* ("dry brown rot"), *Trametes pini* ("ring scale fungus") — *Fomes Laricis* ("sap rot"). The porcupine does little damage and birds do good by destroying harmful insects.

The high winds, which amount at times to tornadoes, in Oregon, do much harm by blowing down the trees. Most of the forests in which *P. pon-*

*derosa* occurs commercially are at least 75 per cent yellow pine; in the pure yellow pine forests of the State, the trees are spaced rather widely. In the Blue Mountains, *P. ponderosa* is associated with *Larix occidentalis* — *Abies concolor* — *Pseudotsuga taxifolia* (Douglas fir) — *Pinus contorta* (Lodgepole pine) — *Pinus Lambertiana* (sugar pine).

In the stands are to be found trees of all ages, from seedlings to veterans 500 years old. In the virgin stands throughout the State a very large proportion of the trees is about 225 or 275 years old; suggesting that after this age their mortality is great. In the Blue Mountains are found per acre 20 to 30 pines from 12 to 30 inches in diameter. *Pinus ponderosa* grows very slowly when young, but its growth is particularly rapid when it reaches from about 75 to 100 years of age; at 150 years of age the tree attains its normal height, and from this time, it only grows from 1 to 2 ft. every 10 years.

The following table drawn up by the writer shows the average height and diameter of these trees at various ages in 13 typical stands in Oregon.

	Age in years							
	50	100	150	200	250	300	350	400
	ft	ft	ft	ft	ft	fr	ft	ft
Average height . . . . .	24	62	90	104	111	115	119	120
	in.	in.	in.	in.	in.	in.	in.	in.
Average diameter at breast height . . . . .	4.7	13.2	19.3	23.4	26.6	29.4	31.1	30.9

The yellow pine grown in Oregon is used in that State for building and construction purposes. The best grades are sent to the neighbouring States, and even to the Eastern States, where the wood is used as a general all-purpose factory material. The lower grade wood is made into boxes and fruit boxes. In the district where it grows, this conifer affords excellent fuel. It is however, only the "pitchy" parts of the tree that are durable in the ground and can be used for posts, fences etc. Yellow pine wood has never been used commercially for paper-making, although experiments made by the Forest Service have proved that it would probably produce a good grade of coarse, wrapping paper. The results of the experiments carried out by the Forest Service show that it is doubtful whether sufficient good turpentine could be obtained to render turpentine profitable.

For replanting, the above-mentioned Service uses trees 2 or 3 years old, for direct seeding has not proved successful.

The Forest Service is also engaged in the management of the forests and their protection from fire; fires in yellow pine woods are comparatively easy to check.

Selection cutting is the rule, periodic cuttings are made, in each of which all the mature, or defective, trees are removed, while the saplings,

poles and young trees are left to form the basis of the next crop. Each tree to be felled is marked by an experienced woodman who selects those of greatest commercial value, and at the same time, seeks to insure the future welfare of the forest.

In the appendix, the writer gives the official instructions for marking timber and burning brushwood.

455— **The Technical Properties of the Wood of the Greek Fir (*Abies cephalonica* Link).** — JANKA, GABRIEL, in *Centralblatt für das gesamte Forstwesen*, Year 42, Parts 9 and 10, pp. 324-338. Vienna, 1916.

At the request of M. ADOLPHE STENGEL, Chief of the Austrian Forest Mission in Greece, and with the permission of the Austrian Minister of Agriculture, the writer has conducted work on the technical properties of the wood of the Greek Fir *Abies cephalonica* Link at the Forest Experiment Station at Mariabrunn. The material for the tests (28 trunk sections and 10 trunks) had been chosen on the spot by the commission and then sent to Mariabrunn. It arrived in a slightly dry state in the spring of 1914, was dried in summer and tested in autumn. It was hoped not only to obtain information as to the technical value of the wood, which had not previously been ascertained, but also to complete the tables of volume and yields in essence, found by STENGEL, to obtain facts for differentiating between the fir *Abies cephalonica* var. *Reginae Amaliae* (which occurs in Arcadia and central Peloponnesus) and the native variety occurring in the rest of Greece (except Cephalonia): *Abies cephalonica* var. *Apollinis*. These results could not be obtained, owing to shortage of material.

From the tabulated results of the tests, it seems that there is no difference, as regards the wood, between *Abies cephalonica* var. *Reginae Amaliae* and *Abies cephalonica* var. *Apollinis*. The wood of the Greek Fir is mostly of bad texture. On account of the lack of control in the forest, most of the trunks have branches nearly down to the ground, lesions at the foot as well as red rot, and often in the upper parts, bunches of mistletoe. The prevention of increase in height and width owing to nibbling by goats causes the formation of narrow rings inside the trunk followed by a rapid increase in height and growth when the terminal bud is sufficiently high to escape the goats.

The trunks being placed too far apart, they increase too rapidly in thickness, which results in wood with the annual rings spaced abnormally and of little strength. Besides, much red wood is produced, owing to compression, which is by no means desirable. Such fir wood cannot be used for fine cabinet work, and is moreover difficult to work. But, if the Greek pine is cultivated according to sound principles, it can produce an irreproachable wood, satisfying all technical requirements. In order to obtain this, its first development should not be hindered and it should not be thinned too early.

The following technical data were obtained by comparing the Greek fir with the ordinary white pine.



	Greek fir	Common white pine
Specific weight of air dried wood .	45.5	43.8
Absolute specific weight . . . .	41.3	40.7
Resistance to crushing . . . . . 320 kg. per cc.		392 kg. per cc.
Hardness . . . . . 333 kg. per cc.		338 kg. per cc.
Ratio $\frac{\text{Resistance to crushing}}{\text{Specific weight of air-dried wood}}$	7.03	8.95
Ratio $\frac{\text{Hardness}}{\text{Specific weight of air-dried wood}}$	7.32	7.72

The ratio between resistance to crushing and the specific weight is always lower for the Greek fir, as at present in Greece, than for white pine. The same is true for the ratio, hardness: specific weight.

The crushing resistance increases inversely to the width of the annual layers.

On the contrary, the hardness of the wood at first decreases with the increase in width of the annual layers, but afterwards increases on account of the greater amount of red wood in proportion as the annual rings increase in width.

There is a direct proportion between the resistance to crushing and the specific weight: the first increases at the same time as the second.

456 - **Forest Management in Formosa.** — *Japan Weekly Chronicle*, No. 757; reprinted in *Revue des Eaux et Forêts*, Year 15, Vol. IV, No. 1, pp. 30-31. Paris, Jan. 1, 1917.

According to a report of the British consul at Tamsui, special attention has been given of late years by the Government to the intensive management of the inland forests of the Island of Formosa.

The wood from the forests of Mount Ari has been largely utilised since 1915, when wood from the Arisan forest was first exported. About three million cubic feet are obtained annually from this forest. The most recent and improved methods are used, and the wood is sent to the Kagi timber-yard in logs.

The Kagi timber-yard is near the starting point of the Arisan railway, which runs along the mountain side for a distance of 41 miles. Aerial transport cables have been fitted up which allow a yield of from 10 800 to 14 400 cubic feet per 10 hour day to be attained.

Two new forests suitable for working have been found in other parts of the island. One of these is in the Taichu prefecture, on the slopes of Mount Hassen, the other is in the Giran prefecture, in the upper reaches of the river Daidakusuike near Mount Sansei.

Attempts are being made by the forestry department to develop the management of the Formosani forests to a still greater degree.

According to the latest estimates the area of the Hassen forest is half that of Mount Ari, whereas the forest in the Giran prefecture is 1 ½ times as big as that of Arisan.

The great transport difficulties at Arisan, where a railway had to be

built, do not seem to exist for the two new forests. In this case there are water-courses down which the logs can be sent either to the coast or to the railway.

457 - The Unsuitable Working of Dammara Forests in the Sultanate of Batjan, in the Moluccas. — See No. 443 of this *Bulletin*.

## LIVE STOCK AND BREEDING.

458 - Auto-Inoculation and Early Development of the Larva of the Horse-Bot (*Gastrophilus intestinalis*) in the Membranes of the Mouth Cavity. — ROUBAUD E., in *Comptes Rendus des Séances de l'Académie des Sciences*, Vol. 164, No. 11, pp. 453-456. Paris, March 12, 1917.

HYGIENE  
OF LIVE STOCK

The method by which the larvae of the Horse-bot (*Gastrophilus intestinalis* de Geer) obtain access to the alimentary canal of their host and the conditions of their early development are not yet known. According to some writers (NUMAN, BRAUER), the young larvae, after hatching, find their way to the mouth and nose of their own accord. The majority of writers consider that they obtain entry to the mouth through licking, after which they are swallowed. According to CHOLODKOVSKY the larvae, after leaving the egg, penetrate the skin of the horse, causing irritations which force the animal to rub the affected spots with his teeth, extract the larvae and swallow them. PORTSCHINSKY, on the other hand, is of the opinion that only certain larvae penetrate the epidermis. They do not develop there but their irritating effect induces the horse to lick and so pick up with his tongue the other larvae which then pass directly into the alimentary canal.

According to the present writer, matters happen in totally different fashion, as may be seen from the following :

a) The eggs of the parasite do not hatch spontaneously and the early larvae may remain in the egg in the resting state for several weeks.

b) The ripe egg liberates its larvae through mechanical contact. It has been shown that a sharp knock at the anterior pole of the egg causes the operculum to spring off and instantly frees the larva, which at once escapes. A moist contact like that of the horse's tongue is not indispensable to effect emergence. Sharp rubbing against the lips or teeth fulfils the same object.

Now, it is known for certain that horses *lick themselves very rarely*; when suffering from local irritation they respond by scratching or rubbing with their mouth.

c) The larvae, freed by contact with the mucous membrane of the lips or gums, immediately penetrate the epithelium.

d) The larvae never perforate the skin. (The theory of the Russian scientists is therefore untenable).

e) The larvae make their way by developing in the mucous membranes of the mouth.

The first stage in the life-cycle of the horse-bot must consequently be read as follows: the larvae remain within the egg until some cause or another induces the horse to rub his lips against the eggs; they are then liberated, bury themselves in the epithelium in which they are caught up and make their way to the deepest parts of the mouth cavity, gradually increasing in size up till their first moult.

Infection is produced when horses scratch themselves with their teeth pretend to bite among themselves, or chase with their mouths the flies, which are worrying them. The chances of infection are considerably reduced if the parts of the body where the eggs are laid are given a light rub from time to time so as to bring about the premature hatching of the larvae.

The early evolution of the *Gyrostigma* (*Spathicera*) of the rhinoceros, owing to the close resemblance of eggs and larvae undoubtedly corresponds closely to that of *Gastrophili*. With regard to the larvae of *Gastrophilus* observed in man in the cutaneous folds of creeping myiasis, everything points to their point of ingress being the external mucous membranes of the eyelids (1) or lips, or some lesion of the skin. These larvae are incapable of having perforated the epidermis directly.

459 - **Diagnosis of Tuberculosis (Especially the Bovine Form) by Complement Fixation.** — FICHHORN, A., and BLUMBERG, B., in *Journal of Agricultural Research*, Vol. VIII, No. 1 pp. 1-2. Washington, D. C. January 2, 1917.

The tuberculin test has been very useful in the diagnosis of tuberculosis, but it has the defects of being somewhat slow, difficult to apply and of easily lending itself to falsification, for animals which have been treated several times no longer react to it. In the search for other reliable means for diagnosis, other tests have been employed: ophthalmic — cutaneous — intradermal and intrapalpebral, but as a whole, they are not so reliable as the subcutaneous test when it is scrupulously carried out. Since the published results on similar investigations are very contradictory, the writers thought it well to devote their attention to the subject of establishing the value of the complement fixation test in tuberculosis.

After explaining the nature of the problem, and giving a historical summary of work so far done on the subject, the writers describe their own experiments which were carried out in the Pathological Division of the Bureau of Animal Industry of the United States Department of Agriculture.

They examined in all 958 samples of bovine serums, 120 samples of hog serums and 22 samples of human serums. The results are set forth in Table I. In order that a clearer conception might be obtained as to whether there exists any relation between the degree of reaction and the character of the disease, it was deemed advisable to separate the cases into 5 groups according to the lesions found on post mortem examination, as follows:

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(1) Eggs of *G. haemorrhoidalis* have been found upon the eyelids and lashes of individuals infected with *Gastrophilus* myiasis. (Author's note).



1) Animals which showed no tubercular lesions and which failed to react to the tuberculin test.

2) Animals which showed arrested lesions, with a limited number of small, slight, caseocalcareous foci confined to the lymph glands.

3) Animals with progressive lesions of a glandular type involving also some of the organs.

4) Animals with well-marked or generalised lesions.

5) Acute and miliary tuberculosis.

The reaction does not appear to be constant and the degree of the reaction seems to have no relation to the extent of the disease. The degree of fixation is also irregular since the slight positive reactions (+) do not occur proportionally with a greater frequency in mild cases than the complete fixation (+++ +). As indicated in Table I, out of 320 negative serums, a total of only 275, or 85.9 per cent., proved distinctly negative on testing; whereas of 370 positive serums 290, or 80.5 per cent., were positive, and 90 (or 7.6) were atypical. The grand total of 81.6 per cent of accurate reactions obtained is by no means sufficient to make the test practical for the control of the disease.

In order to see the comparative practical value of the method elaborated by the writers and described in their article, their antigen should be compared with those prepared by other investigators. Table II shows the results obtained by comparison with BESREKA's antigen.

*Conclusions.* — 1) The complement-fixation test for the diagnosis of tuberculosis in cattle is not so reliable as the subcutaneous tuberculin test.

2) Since a large proportion of the positive cases give only a faint reaction, it necessitates a very careful titration of the antigen and a most accurate observance of all the details of the technique of the case.

TABLE I. — *Summary of the Tests Conducted with Antigen Prepared from a Bacillary Emulsion and Tuberculin Precipitate.*

Bovine Serum	Total number	Degree of fixation						Percentage
		++++	+++	++	+	±	—	
Group 1:								
Serums from animals without tubercular lesions and negative to the tuberculin test . . .	320	3	2	10	13	17	275	85.94
Group 2:								
Serum from animals showing arrested tubercular lesions . . . . .	207	21	28	39	48	19	52	77.15
Group 3:								
Serum from animals with progressive lesions.	79	11	16	23	16	5	8	83.56
Group 4:								
Serum from animals showing generalised, well marked, or extensive lesions . . . . .	43	12	9	4	7	4	7	74.42
Group 5:								
Serums from animals showing acute or miliary lesions . . . . .	31	9	4	4	10	1	3	87.1
Total . . .	680	56	59	80	94	46	345	81.63

TABLE II. — *Summary of Tests Conducted for Comparative Purposes with (I) Antigen of BESKREDA and (II) the Antigen Prepared from a Bacillary Emulsion and Tuberculin Precipitate.*

Groups *	Number of cases	Degree of Fixation												Percentage	
		++++		+++		++		+		±		—		I	II
		I	II	I	II	I	II	I	II	I	II	I	II		
1	91	2	—	1	2	1	1	4	3	—	—	81	83	91.1	93.4
2	35	2	—	—	—	1	—	12	19	4	7	16	9	42.80	54.29
3	3	—	—	—	—	—	—	2	3	1	—	—	—	66.67	100
4	1	—	—	—	—	—	—	—	—	—	—	1	1	—	—
5	6	—	—	—	—	1	1	—	—	4	4	1	1	16.35	16.35
Totals . . .	136	4	—	1	2	3	2	18	25	10	11	99	94	Average 43.58	Average 66.16

\* The groups are the same as in Table I.

3) The amount of fixation cannot be considered as an index of the extent of infection. Frequently, samples from animals showing arrested retrogressive lesions give a more marked fixation than animals affected with acute, progressive, generalised tuberculosis.

4) The complement-fixation test might be employed as a supplementary test in cases of doubtful or atypical reactions to the subcutaneous or other tests.

5) The subcutaneous tuberculinisation of healthy animals affects the results of the complement-fixation test. Such interference may be noted as early as the fourth day following the injection and may persist for at least 6 weeks and possibly for a much longer time.

6) There is no material difference in the reliability of the test in cattle as compared with human beings.

7) Comparative tests with various antigens proved that one prepared with bacillary emulsion and tuberculin precipitate is the most effective.

8) Antibodies do not appear to be constantly present in tuberculous animals.

#### 460 — Anti-rinderpest Serum Preparation at the Muktesar Laboratory India. —

SHILSTON, P. W. in *Agricultural Research Institute, Pusa, Bulletin*, No. 64, pp. 1-18. Calcutta 1916.

The series of observations described in this paper were carried out to ascertain the potency of sera taken 8, 12 and 16 days after the injection of virus and to compare the results with those given by sera taken 15 and 17 days after injection ; the latter intervals were those allowed in the routine method of serum manufacture followed at the Muktesar Laboratory, the bleeding being taken at the rate of 6 cc. and 8 cc. per lb. body weight

respectively. The three bleedings at four days intervals were all taken at the rate of 6 cc. per lb.

Previous experience had shown that cattle would stand bleeding to this extent with little or no interference to their health and it seemed probable that the potency of the sera from the second and third bleedings would not be found to diminish as rapidly as when intervals of a week are allowed between the bleedings; the saving in time would also be a consideration. Tests were made of the potency of the mixed sera from the two series and were repeated on a large scale using both hill bulls and buffaloes for serum production.

As the main purpose of the experiments was to provide an increased yield of serum which should be at least of equal potency to that prepared by the existing routine method, records were kept of the amounts of serum obtained at each bleeding and the total yields given under the two systems were compared.

Throughout the experiments the potency of the sera was tested on susceptible hill bulls, six for each test, by injecting them simultaneously with virulent rinderpest blood (to which a solution of potassium citrate was added) and graduated quantities of the serum. In the routine serum testing, doses of 36 cc., 72 cc. and 108 cc. per 600 lb. body weight were administered, two bulls being treated simultaneously; these amounts being equivalent to 2 cc., 4 cc. and 6 cc. respectively in the case of plain animals which, on account of their low susceptibility, require eighteen times as small a dose of serum as hill bulls, the latter having an uniform high susceptibility. In order to gain a more accurate estimate of the relative values of the sera, the doses throughout the experiments were fixed at 27 cc., 54 cc. and 81 cc. per 600 lb. body weight, equal to  $1\frac{1}{2}$  cc., 3 cc. and  $4\frac{1}{2}$  cc. respectively for plain cattle.

At each test two hill bulls were inoculated with virulent blood alone to serve as controls; after developing symptoms of acute rinderpest these were bled to death to provide virulent blood for hyperimmunization.

The results of the above experiments showed that the interval allowed between the injection of the rinderpest blood and the first bleeding for serum in hyperimmune animals may, with advantage, be reduced to 8 days, as the immune bodies are then present in full amount. By taking three bleedings at the rate of 6 cc. per lb. body weight on the 8th., 12th. and 16th. days after injection a mixed serum was obtained of equal (hill bulls) or increased (buffaloes) potency to that obtained by taking two bleedings 15 and 17 days after injection at the rate of 6 cc. and 8 cc. per lb. body weight respectively, as was done in the routine method followed at the Muktesar Laboratory. The actual yield of serum after each injection was increased from 6.79 c.c. per lb. body weight by the two bleedings system to 9.6 cc. by the three bleedings system or an additional 2.81 cc. of serum per lb. body weight; an increase of 41.4 % on the former output.

With an average issue of over 500 000 cc. of anti-rinderpest serum per month this increase without additional expenditure represents a very large reduction in the cost of manufacture.



461— *Glossina* and Pig Trypanosomiasis in the Inkissi Valley, Middle Belgian Congo.—  
See No. 400 of this *Bulletin*.

FEEDS  
AND FEEDING

462— Value of "Bersim" (Alexandrian Clover) for Feeding Stock; Experiments in Egypt. — PIOT, J. B., in *Bulletin de l'Union des Agriculteurs d'Egypte*, 14th Year, No. 114, pp. 14-22, 1 diagram. Cairo, 1916.

Following the rotation of cotton soils in practice in Lower and in a portion of Upper Egypt, distinction is made between "Bersim" *târîche* (improving) and "Bersim" *moustadîm* (permanent).

The former immediately precedes the cotton in the rotation; it is fed off once only in the large plantations, where the soil must be prepared with all speed for receiving the cotton crop; the land is then ploughed and the remains of the crop are turned under and form a nitrogenous fertiliser. Small planters who only cultivate once or twice at close intervals for the cotton, plough as late as possible and take off as many as 2 or even 3 cuts of Bersim.

In general practice, the area sown in Bersim *târîche* is calculated so as to provide sufficient forage to feed the stock up to the time of ripening of the Bersim *moustadîm*.

The sowing down of vast areas to Bersim *târîche* has induced Mr. JEFFERYS, of the Administration of Domains, to carry out tests with ensilage. This would enable a moist fodder to be prepared for the summer months and one relished by stock.

Bersim *moustadîm* is generally broadcasted in fields of irrigated cotton before the final picking. In this way it reaches maturity just in time to replace the Bersim *târîche*. Usually 3 cuts are obtained, the last of which is partially preserved for seed and partially converted into *driss* or dry fodder.

Bersim is thus administered to stock in 3 forms: green, as pasture or a soiling crop; dry, as *driss* and as ensilage.

Of recent years, thanks to the remarkable improvement of vast areas more or less saturated with salt, the Administration of Domains has been able to extend considerably the area under Bersim *târîche* and *moustadîm* and to obtain enormous quantities of ensiled Bersim and of *driss*. In this way, the Administration has had every facility for conducting experiments on the value of Bersim in all 3 forms for the feeding of young cattle.

In an experiment with calves (about 6 months old), green Bersim, pastured or soiled, gave an increase of 68 % on the initial weight, thus proving itself to be a first class food for young stock.

Summer feeding with *driss* or ensiled Bersim has been shown to be inadequate to ensure normal development in young cattle. In 6 months it has only given an increase in live weight of 8 to 9 %. This difference appears to be paradoxical and the writer intends investigating the reason.

Additional experiments have shown that ensiled Bersim *târîche* is preferable to ensiled permanent Bersim. Permanent Bersim should therefore be reserved for preparing *driss*.

It must be concluded on the basis of the experiments that *driss* and ensiled Bersim are insufficient to ensure proper growth in calves and that it

seems indispensable to supplement these fodders by a ration of bean, maize, cake, etc.

With regard to mature cattle, the experiments have shown that ensiled Bersim may suffice as a maintenance ration, when the animals are at rest, if working, a supplementary ration of beans and straw should be added

463 - **Employment of Ground-Nut Cake in the Feeding of Livestock.** — HEIM, F., in *Bulletin de l'Office Colonial*, 10th Year, No. 109, pp. 44-52. Melun, Jan. 1917.

At the present moment, the question of the utilisation of ground-nut cake (which before the war was exported chiefly to Germany, Holland and Scandinavia) is of considerable interest to France and her colonies. In consequence, the writer has been induced to make a thorough investigation of the value of this product for the feeding of live-stock. He gives the results of his reasearches carried out in collaboration with Messers P. DECHAMBRE and LÉPOUTRE at the Zootechnical Station of Grignon and at the Laboratory of Phytotechny.

Table I gives a summary of the analyses of decorticated ground-nut with regard to their content of digestible principles.

TABLE I. — *Composition of ground-nut cake*

A. — *Proportion of digestible principles in decorticated ground-nut cake.*

	GRANDEAU	WOLFF	KELLNER	MAYER, KIRCHNER AND PETERSON
Water. . . . .	12.85 %	11.5 %	9.0 %	10.3 to 13.22 %
Nitrogenous matter . . . . .	48.44	47.0	46.7	41.3 - 50.4
Fats . . . . .	6.2	7.3	6.3	5.8 - 8.1
Non-nitrogenous matter. . . . .	25.99	24.1	20.6	21.45 - 28.4
Fibre. . . . .	1.8	5.2	0.5	2.5 - 10.1
Ash. . . . .	5.42	4.9	4.5	3.8 - 5.9

B. — *Average mineral content in Rufisque ground-nut cake.*

Phosphoric acid. . . . .	1.17 %	Lime . . . . .	0.16 %
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The digestibility of the elements contained in ground-nut cake is high. Table II shows, according to KELLNER, the coefficients of digestibility that may be admitted in practice for determining the content in digestible principles of a cake of which the gross percentage composition is known.

TABLE II. — *Digestibility coefficients of ground-nut cake according to KELLNER.*

Organic substances . . . . .	83 %
Crude protein . . . . .	99
Crude fat . . . . .	90
N. free extract. . . . .	84
Crude fibre . . . . .	9.

Ground-nut cake shows the highest albuminoid content. See Table III (after KELLNER).

TABLE III. — *Comparative albuminoid content of various cakes.*

Decorticated ground-nut . . . . .	46.7 %
Decorticated cotton cake . . . . .	41.3
"Candle nut" (Fruit of <i>Aleurites moluccana</i> ). . . . .	39.7
Sesame . . . . .	35.8
Linseed . . . . .	28.8
Colza . . . . .	27.4
Copra . . . . .	16.7
Palm-nut . . . . .	13.5

It may be said that ground-nut cake, if pure, is a high yielding food, that is to say, it requires only a small energy output for its digestion and assimilation. Its utilisation coefficient is 98 where that of wheat is only 78; that of meadow hay 67, that of oat straw 43, that of wheat straw 32.

Ground-nut cake is often adulterated with the shells of the fruit. This greatly decreases its value.

The use of ground-nut cake in a ration means, before all else, the introduction of a high quantity of easily assimilable proteins and so is particularly adapted for feeding young and milk-producing animals, especially for high yielding dairy animals. It is equally suitable for oxen in poor condition owing to overwork and which it is required to fatten for the butcher. Owing to its slight flavour, ground-nut cake communicates no bad taste to the meat.

Rations formed of food-products cropped from the farm itself almost invariably show a deficit of protein. This lack can be readily supplied by ground-nut cake and at relatively low cost. There is undoubted advantage in introducing this cake into the rations of every day practice which, though often rich enough in non nitrogenous substances too often show a deficit of protein.

Ground-nut cake is put on the market in flat cakes or as flour. Owing to its insipidity, animals do not always accept it readily and it is advisable at first to add a little kitchen salt to the mashes and feeds containing the cake. It is administered in small quantities at first, and then continued in a progressive manner. The actual flat cake should be either powdered or broken up into fragments about the size of nut; it can then be consumed in the dry state or in the form of soup or a mash. As ground-nut cake is somewhat heating owing to its high protein content, it is advisable to introduce into the ration aqueous or emollient foods (pulp, forage roots, linseed cakes).

The dairy cow consumes, according to milk yield, from 1 to 2 kg. of ground-nut cake. Within these limits the milk and butter remain of excellent quality, but above these quantities the butter becomes soft and unsaleable. The writer and his collaborators propose to investigate what constitutes the limit dose. Ground-nut cake forms an excellent addition to rations with a turnip base; it corrects the disagreeable flavour produced in these conditions.

Ground-nut cake in flour is sometimes employed in the calf ration. A start is made with 50 to 100 gr., finishing up with 750 gr. Young stock



receives from 500 gr. to 1 kg. per 500 kg. of live-weight. The price of the cake is rather too high to allow of its every day use in the ration of working oxen or of animals for the butcher, but it serves this purpose very well.

Sheep and pigs give excellent meat on ground-nut cake.; the daily ration consists of 250 to 500 gr. per head.

In substituting ground-nut for another cake, account must be taken of its high protein content. It would be a great error to substitute it weight for weight, especially in a fattening ration.

*Employment of ground-nut cake for feeding horses.* — Messrs. GOUIN and ANDOUARD have recently given an account at the Academy of Agriculture in France, of the encouraging results they have obtained by introducing ground-nut cake, in place of manioc slices, into the ration of farm horses. The writer and his two collaborators have continued these experiments on a batch of horses at the Grignon Zootechnical Station.

The taste of the horse for ground-nut cake is undoubted, the majority accept it straight away; cases of initial refusal are overcome in 2-3 days.

The cake produces no visible effect upon the health or main functions of the animal. It is therefore perfectly suited, either to replace a portion of the oats in a normal ration, or to complete a deficient ration; 1 kg. of cake is equivalent to 1.350 kg. of oats, and represents an economy of 0.14 francs.

It should be administered in progressive amounts, given at 2 separate meals when the quantity exceeds 500 gr.; the cake should be coarsely ground or crushed into fragments not exceeding a nut in size. At first it should be given mixed with dry feeds or bran; later on the animals become accustomed to taking it alone.

464 — **Sound Reasons for Pure Breds.** — SEVERSON, B. O., in *The Field*, Vol. XXVI, No. 8, pp. 670-672. New York, August 1916.

BREEDING.

Although pure-breds offer a greater surety of merit in selection than do scrubs, there are animals amongst them which are not necessarily desirable. The importance of individual merit even for pure-breds may be gathered from the data contained in Table I, compiled from the Advanced Registry of the Holstein-Friesian Breed up to May 15, 1912, which includes 1191 bulls.

From these facts it is apparent that the percentage of bulls having the highest number of Advanced Registry daughters come from parents that were recorded in the Advanced Registry; this is indicated by an increase of from 50 to 100 %. Similarly the breeding merit of cows is determined by heredity, as is seen in Table II, which shows an increase of from 58 to 100 % in the number of daughters whose dams were entered in the Advanced Registry. With cows, as with bulls, the most prepotent animals are those whose merit depends upon performance based on heredity.

TABLE I — *Breeding of Holstein Friesian Bulls.*

(Vol. 24, "Advanced Registry").

No. of Registered Daughters per Sire	Total No. of Bulls	Both Sire and Dam in A. R. Registered per cent	Neither Sire nor Dam in A. R. Registered per cent	Sire in A. R. Registry not Dam	Dam in A. R. Registry not Sire
4-14 . . . . .	948	51	20	20	9
15-24 . . . . .	155	76	3	10	11
25-49 . . . . .	65	72	0	12	16
50-75 . . . . .	13	77	0	8	15
75 and up . . . . .	10	100	0	0	0

TABLE II. — *Breeding of Holstein-Friesian Cows with two or more Daughters in the advanced Registry (Vol. 24).*

No. of Advanced Registry, Daughters per Dam	Dams with Records		Dams with no Records	
	No. of daughters	Percentage of daughters	No. of daughters	Percentage of daughters
2-3 . . . . .	2 181	58	1 604	42
4-5 . . . . .	286	76	89	24
6-7 . . . . .	18	90	2	10
8 . . . . .	2	100	0	0

465 — **Feeding Experiments of Pure Bred Draft Fillies in Illinois.** — EDMONDS, J. L., in *The Field*, Vol. XXVIII, No. 2, pp. 95-97 and 128. New York, February, 1917.

The plan of this experiment conducted at the Illinois Experiment Station included the purchase of ten pure bred Percheron fillies dropped in the spring and summer of 1914, and began December 8, 1914, being completed May 8, 1916. At the beginning of the experiment the average age of the ten heads was 214 days, with an average weight of 823 pounds and an average height of 13 hands, 2  $\frac{1}{3}$  inches. With the exception of a few of the most stormy nights of winter, the fillies had their choice of being outdoors or in, and they usually preferred the open except at feeding times, and during the heat in the summer. The pasture season lasted from May 14 to October 11, 1915.

The accompanying table shows the feed consumption and gains by season.

*Feed consumed and gains by seasons.*

Time	Average daily ration per head		Average amount of feed required per pound gain		Average daily gain in weight per head	Average total gain in weight per head	Average total gain in height per head
	Grain lbs.	Hay lbs.	Grain lbs.	Hay lbs.	lbs.	lbs.	inches
<i>First Winter</i>							
Dec. 8–May 13, 157 days	11.023	8.287	5.674	4.266	1.943	305.0	4.17
<i>Summer</i>							
May 14–Oct. 11, 151 days	6.469	3.505	7.602	4.118	0.851	128.5	1.93
<i>Second Winter</i>							
Oct. 12–May 8, 210 days	11.293	15.897	9.228	12.990	1.224	257.0	1.86
<i>Total: One year and 5 months . . . . .</i>	<b>9.805</b>	<b>9.978</b>	<b>7.356</b>	<b>7.485</b>	<b>1.333</b>	<b>690.5</b>	<b>7.96</b>

The largest gains, in proportion to feed consumed were made during the first winter, with an average of 5.674 pounds of grain, and 4.266 pounds of hay required per pound gain.

The grain fed consisted of oats and corn, one half each by weight and was fed three times a day, except while the fillies were grazing, when the mixture was fed twice a day. During the first winter the oats and corn were ground and after that whole oats and shelled corn were fed. The only roughage fed was alfalfa hay, being placed before the fillies twice a day except when on pasture, during a part of which time no hay was fed at all. This method of feeding resulted in no feed being wasted, and eliminated the necessity of weighing back refused feed.

The results obtained indicate that a liberal portion of well cured legume hay is a good foundation of feed for growing horses and that, as the individual becomes older it is possible and desirable to decrease the proportion of grain and increase the proportion of hay and still obtain excellent results. A grain feed approximating one-half pound per day to the hundredweight of filly seems to be enough to produce proper development on pasture. This experiment demonstrated the superiority of alfalfa in growing the heavy muscles and large strong bones of the drafters.

An average of 45.35 bushels of corn, 79.36 bushels of oats, 2.58 tons of alfalfa and  $\frac{4}{5}$  of an acre of good pastures, kept the pure bred Percherons, and in the experiment, in thrifty and salable conditions from the fall of the year in which they were foaled up to the time they were two years of age. during the 18 months in which this feed was consumed the average total gain in weight per individual was 690.5 pounds and in height 7.96 inches. The average weight of the lot at 12 months was 1 112 pounds and at 24 months 1 548 pounds. The average total cost of feed per head was \$56.07 for the year and \$86.88 per the 18 months. It is believed that on many-farms, where pure bred are raised, the same results could be obtained



for less, rather than more expense for feed, using more pasture than was available in this trial.

## CATTLE

466 - **The Niata Breed of Cattle in Uruguay.** — *The Journal of Heredity*, Vol. VII, No. 6, pp. 263-265. 2 fig. Washington, D. C., June 1916.

The peculiar jaw characteristic of a bull-dog is a mutation which is not confined to the dog alone, but appears from time to time in other animals. It has been reported in foxes, and CHARLES DARWIN found a whole race of cattle in Uruguay which showed this peculiarity. He described the animals as follows — forehead very short and large — the nasal end turned up — upper lip very short — lower jaws projecting beyond the upper — teeth always exposed — nostrils seated very high up and very open — eyes projecting. These cattle carry their heads low on a short neck; their hind legs are rather longer compared with the front legs than is usual. This breed which is called “niata” or “ñata” is believed to have originated among the Indians southward of La Plata. The breed is very true. When crossed with ordinary cattle, offspring are produced having an intermediate character, but with the “niata” characters strongly displayed, especially when the “niata” cow is crossed with a common bull.

When the grass is sufficiently long, the “niata” cattle feed with the tongue and palate like common cattle, but during the great droughts, when so many animals perish, the “niata” breed is under great disadvantage, for as their lips do not join, they cannot browse on the twigs of trees and on reeds as the ordinary cattle are able to do, and thus perish in greater numbers than the latter.

The American Genetic Society, with some difficulty, finally succeeded in securing 2 photographs (reproduced in the article summarised) of animals from a rancher, but it is probable that they are not full blooded ñatas, for the race is practically extinct. The introduction of the best European breeds, particularly the Hereford, into Uruguay in recent years, has raised the standard of livestock so much, that it is no longer profitable to keep “ñata” cattle.

In order to prevent the entire disappearance of these interesting animals the American Genetic Association suggests that they should be bred in Zoological Gardens.

467 - **The Efficiency of Certain Milk Substitutes in Calf Feeding.** — CARR, R. H., SPITZER, C., CALDWELL, R. E., and ANDERSON, O. H., in *The Journal of Biological Chemistry*, Vol. XXVIII, No. 2, pp. 501-509. Baltimore, Md., January, 1917.

This paper contains an account of experiments carried out at Purdue Experiment Station in order to determine:

- 1) To what extent a calf meal made up of both animal and vegetable feeding materials, rich in protein, could take the place of skim milk;
- 2) Whether the proteins from wholly vegetable sources are capable of producing growth and development of the calf to the same extent as the proteins from animal sources.

The skim milk, prepared by a cream separator, was fed fresh at a temperature of about 90° F., or practically body temperature. The calf meals,

fed at the same temperature as the skim milk, were mixed with water, 4 ounces of meal to 3 pounds of water at first, increasing to 12 ounces of meal to 9 pounds of water. The dry mash consisted of equal parts of ground corn and oats. The alfalfa hay was also fed dry. Salt and water were allowed *ad libitum*. The calves were allowed as much of each feed as they would consume, and any rations that were left were carefully weighed. Tables I and II give a record of the feeding periods and feeds received by each calf.

TABLE I. — *Feed Chart.*

Feeding Periods and Feeds Received by Each Calf.

Calf	B 40	B 43	B 41	B 44
Period I 29 days	{ Skim milk Alfalfa hay Dry mash	{ Skim milk Alfalfa hay Dry mash	{ Vegetable meal Alfalfa hay Dry mash	{ Home mixed meal Alfalfa hay Dry mash
Period II 25 days	{ Home mixed meal Alfalfa hay Dry mash	{ Vegetable meal Alfalfa hay Dry mash	{ Skim milk Alfalfa hay Dry mash	{ Skim milk Alfalfa hay Dry mash
Period III 18 days	{ Vegetable dried blood meal Alfalfa hay Dry mash	{ Home mixed casein meal Alfalfa hay Dry mash	{ Vegetable dried blood meal Alfalfa hay Dry mash	{ Home mixed casein meal Alfalfa hay Dry mash

TABLE II.

Composition of Meals.

1) Vegetable meal. . . .	{ Linseed meal. . . Soy bean meal. . . Cottonseed meal . Wheat middlings .	Equal parts by weight. N. 4.97 per cent.
2) Home mixed meal . .	{ Hominy feed . . . Linseed meal . . . White Swan flour Dried blood . . .	Equal parts by weight. N. 5.60 per cent.
3) Vegetable dried blood meal	{ Soy bean meal. . . Linseed meal. . . Cottonseed meal . Wheat middlings . Dried blood . . .	Equal parts by weight. N. 6.00 per cent.
4) Home mixed casein meal	{ Hominy feed . . . 9 parts by weight Linseed meal . . . 9 " " " White Swan flour . 9 " " " Casein. . . . . 8 " " "	N. 5.02 per cent.

Nitrogen content of other feeds:

Skim milk . . . . .	N. 0.55 per cent.
Mash. . . . .	N. 1.46 per cent.
Alfalfa hay . . . . .	N. 2.53 per cent.

Tables and diagrams are given of the following data obtained by taking an average of the figures by 3 day periods: — nitrogen intake, nitrogen retained, total nitrogen excreted in urine, nitrogen excreted in the form of urea, nitrogen excreted in the faeces, the body weight, the body gain, the weight of the urine and the amount of dry matter or solids in the faeces. The results obtained are summarised as follows:

I. — *Percentage retained of nitrogen consumed in the ration:*

Skim milk ration . . . . .	40.7
Home mixed meal . . . . .	32.0
Home mixed casein meal . . . . .	30.0
Vegetable meal . . . . .	27.3
Vegetable dried blood meal . . . . .	22.6

II. — *Division of excreted nitrogen:*

	In urine	In faeces
Skim milk ration . . . . .	50.5	49.6
Home mixed casein meal ration . . . . .	46.3	53.7
Vegetable meal ration . . . . .	41.2	58.8
Vegetable dried blood meal ration . . . . .	35.0	64.9
Home mixed meal ration . . . . .	34.2	65.2

III. — *Gain in gm. of body weight per gm. of nitrogen consumed for the different rations.*

	gm.
Skim milk . . . . .	34.41
Home mixed casein meal ration . . . . .	32.74
Vegetable dried blood meal ration . . . . .	26.85
Home mixed meal ration . . . . .	26.17
Vegetable meal ration . . . . .	26.14

CONCLUSIONS: — 1) The nitrogen intake was rather constant per kilo of body weight. The maximum difference was 12 per cent.

2) Less nitrogen was excreted from the vegetable ration than from the dried blood ration, there being a difference of 4.7 per cent.

3) It seems that when the nitrogen in the ration was the most suitable for growth, the nitrogen excreted was about evenly divided between the faeces and the urine.

4) The total nitrogen excreted from each of the five rations indicates that the nitrogen in the skim milk ration was absorbed to the greatest advantage and the other feeds in the order named: home mixed meal, home mixed casein meal, vegetable meal, and vegetable dried blood meal.

SHEEP

468 — **Lamb Feeding in Texas.** — JONES, J. M., in *The Breeder's Gazette*, Vol. LXXI, No. 7, pp. 327-328. Chicago, February 15, 1917.

Feeding experiments have been carried out on a large farm in Coleman county by the Texas Experiment Station with a view to obtaining reliable information regarding the use of cottonseed meal, cottonseed hulls and silage hulls, and silage made from sorghum and feterita in the fattening of sheep.



	1st period: 59 jours		2nd period: 24 days		3rd period: 19 days		4th period: 17 days	
	Group I	Group II	Group I	Group II	Group I	Group II	Group I	Group II
Daily ration:								
Cottonseed meal . . . . .	0.236 lb.	0.229 lb.	0.445 lb.	0.318 lb.	0.445 lb.	0.37 lb.	0.448 lb.	0.366 lb.
Cottonseed hulls . . . . .	0.898 lb.	—	1.00 lb.	—	1.017 lb.	—	0.99 lb.	—
Sorghum and feterita silage. . . . .	2.24 lb.	3.78 lb.	2.53 lb.	3.46 lb.	2.68 lb.	3.48 lb.	2.59 lb.	3.46 lb.
Milo and feterita chops. . . . .	—	—	—	0.89 lb.	—	1.04 lb.	0.736 lb.	1.03 lb.
Daily cost of ration . . . . .	\$ 0.0093	\$ 0.0095	\$ 0.0127	\$ 0.0198	\$ 0.0132	\$ 0.0222	\$ 0.02	\$ 0.022
Average daily gain for each period . . . . .	0.349 lb.	0.285 lb.	0.31 lb.	0.34 lb.	0.173 lb.	0.285 lb.	0.048 lb.	0.24 lb.
Cost per pound of gain . . . . .	\$ 0.0267	\$ 0.332	\$ 0.0411	\$ 0.0579	\$ 0.0760	\$ 0.0777	\$ 0.29	\$ 0.0909
Average daily gain for first 2 periods . . . . .		0.338 lb.	Group II 0.352 lb.		Group I —		Group II —	
Cost per pound of gain for first 2 periods. . . . .		\$ 0.0305	\$ 0.0413		—		—	
Average daily gain for last two periods. . . . .		—	—		0.120 lb.		0.262 lb.	
Cost per pound of gain for last 2 periods . . . . .		—	—		\$ 0.135		\$ 0.083	

For the experiment, 501 lambs of the Shropshire Delaine cross were divided into two lots of 250 and 251 each. The tests were carried out in four periods of 59-24-19-17 days respectively. Table I shows the composition and cost of the daily ration as well as the gain in weight and the cost of this gain.

The experiments showed that silage when fed to lambs in moderate quantities gives good results in every way. In spite of its high water content it did not appear necessary to add dry roughage to the ration of fattening lambs receiving silage. The animals of Group I which were fed cottonseed hulls showed, in the 1st period (59 days), a greater increase in weight than those of Group II, which received a larger amount of silage but no dry roughage. On the other hand, when milo and feterita chops were added to the ration, Group II showed a greater increase in weight than Group I throughout the duration of the experiment. These facts show that the addition of dry roughage to a silage ration is advisable from an economic point of view although not strictly necessary from a hygienic standpoint. The lambs of Group I returned a profit of \$ 1.03 per head, or 38.3 % on the original investment, whereas those of Group II returned a profit of 82 cents per head or 30.3 % on the original investment.

## POULTRY

469 - **Injurious Effect of Palpating Laying Hens in order to determine the Presence of Eggs.** — KITT, TH., in *Monatshefte für praktische Tierheilkunde*, Vol. 28, Part 5-6., pp. 256-265. — Stuttgart, March 20, 1917.

Many poultrymen have the habit of palpating laying hens every day about the abdomen in order to ascertain the presence or not of an egg. This practice is usually inoffensive, but it is sometimes the cause of lesions more or less serious in character and in some cases even followed by death. Undoubtedly, it is not always followed with the necessary care and it often happens that the liver and the eggs themselves are crushed. When done by an inexperienced person it may be the cause of a regular mortality among the poultry which is often wrongly attributed to epidemics or poisoning. Journals dealing with poultry have hardly ever mentioned a case of death due to this cause.

In the majority of cases, fowls which have been too roughly handled have their livers ruptured, especially where this organ has been rendered delicate by overfeeding. As a result, internal hemorrhage occurs which may be immediately confirmed, when the abdominal cavity is opened, by the presence of extravasation of blood and coagulum among the intestines and upon the rupture of the liver. Death is not always immediate but the animals succumb the following day, following symptoms of paralysis.

Rupture of the liver, however, may be due to other causes, such as particularly violent efforts of the male in copulation or to the body of the fowl being squeezed between the laths of a garden coop or in a too narrow passage.

The crushing of eggs owing to hand pressure is rarer if the egg has reached the lower portion of the oviduct and if it is already provided with the calcareous shell than when it is still in process of formation. In this latter case the incompletely hardened shell is crushed. Still more frequent is the case where the eggs are crushed in the ovarian follicles in the middle

of the abdominal cavity. In this case the body cavity is quite full of yolk which makes its way into all the interstices and folds between the intestines and the air sacs. Internal hemorrhage and foci of inflammation being completely absent in such cases the cause of death is problematic. The writer considers that portions of yolk from the body cavity, obtaining access to the bronchi opening into the abdominal air sacs, may be inhaled into the lungs, death then ensuing owing to asphyxia.

The presence of yolk in the abdominal cavity is not always to be imputed to the crushing of an egg as a result of a traumatic lesion. In several illnesses it may happen that one or more ovarian follicles may be released prematurely and the yolk spread into the abdominal cavity. For instance, this is one of the initial symptoms in fowl cholera and especially in the Lombardy disease of poultry. The yolk may also burst into the abdominal cavity when there is an obstruction of the oviduct. In such cases the newly formed eggs without shell become massed in the oviduct, increase in size and often leak into the body cavity.

Where the accumulation of yellow in the body cavity does not actually result in death as described above, it is still followed by internal troubles. After partial reabsorption of the aqueous portion of the yolk there remain behind hard and fatty portions which seal together more or less closely the organs of the abdomen. The result is interference with the peristaltic functions and the animals eventually die of "cibostasis" (stoppage of digestion).

Many poultry keepers also feel for the presence of an egg by introducing the finger into the cloaca. This is a very bad practice as lesions may result. There is also considerable risk of infection causing inflammation of the oviduct.

470 - **Breeding of 3 Chinese Races of Silkworms at the "Osservatorio bacologico Marson" at Vittorio Veneto, Italy.** — MARSON, D., in *Informazioni Seriche*, Year IV, No. 4, pp. 76-77. Rome, February 20, 1917.

SERICULTURE

The following races have been studied, imported by the MARI mission:

Large white oval from Zi-Ka-Wei . . . . .	50 cells
Chinese gold from Sagnew. . . . .	80 "
Chinese gold from Vusih. . . . .	50 "

The layings from each moth were reared separately in order that the selection should be carried out under the strictest conditions. The results obtained are as follows:

1) *Large white oval from Zi-Ka-Wei* (cells received 50; found healthy 19).

Average duration of 8 breedings: 24 days. Worms white rather big, rather lacking in agility, method of progress regular. One breeding lot was abandoned where some worms were found to be poorly developed at the 4th period. Cocoons oval, white, developed, average resistance and rather coarse grain; 62 live cocoons weigh 100 gr. Dimensions in centimetres:

	Maximum	Minimum	Average
Width . . . . .	2.10 cm.	1.90 cm.	2.00 cm.
Length. . . . .	4.10	3.40	3.75



This race showed no remarkable features; however, the proportion of double cocoons was fairly high and reached in some cases 9 %. After rigorous selection, the cocoons have been reproduced.

2) *Chinese gold from Sagnew* (cells received 80; found healthy 3).

The three small breedings were carried out at Carpisica, Ogliano and Fregona respectively. The first two have given the following results:

Duration of breeding period: 21-23 days — Cocoons oval, lemon gold; tissue compact: 47-39 — Cocoons oval lemon gold, shade only slightly uniform, light: 26-21 — Cocoons of faded greenish yellow, very light: 8-22 — Cocoons silvery white, some spherical but the majority oval and finely grained: 22-19 — Double cocoons: 6-14.

The lemon gold cocoons with consistent tissue were reproduced. 79 cocoons weigh on an average 100 grams. Dimensions in centimetres:

	Maximum	Minimum	Average
Length . . . . .	3.10 - 3.20 cm.	2.50 - 2.90 cm.	2.80 - 3.05 cm.
Breadth . . . . .	1.90 - 2.00	1.60 - 1.90	1.75 - 1.95

The 3rd. breeding, which was normal and lasted 22 to 24 days gave: 31 semi-spherical cocoons, bright gold and rather fine grain, resistant and extremely well developed, as the following figures show:

Length 3.1 cms; breadth 2.1 cms.

63 live cocoons weigh 100 gr.

46 cocoons of similar shape and dimensions to the preceding ones but less developed, 77 weigh 100 gr. Average dimensions: Length 2.7 cms.: breadth 2.1 cms.

13 white cocoons, some round, the rest oval.

3 straw-coloured cocoons, semispherical.

23 greenish yellow cocoons, only slightly uniform.

6 double cocoons.

In view of their marked difference in size the two bright gold types were bred separately. They deserve attention owing to the richness of their silk and the bright colour of the cocoon.

3) *Chinese gold from Vusih* (cells received 50; found sound 13).

Average breeding period: 22 days. Worms active, method of progress regular. The cocoons obtained were at first mostly lemon yellow in colour, acquiring later a uniform greenish yellow tint. Fairly compact. A certain number yellowish gold colour of various shades, extremely light. Practically an equal number of white, round to oval, some tinged with silver, which have been in part reproduced. The proportion of double cocoons varies between 4 and 6 %. The oval, lemon or yellowish gold cocoons were reproduced after rigorous selection; 81 cocoons weigh 100 gr.

	Maximum	Minimum	Average
Length . . . . .	2.90 cm.	2.70 cm.	2.75 cm.
Breadth . . . . .	1.80	1.50	1.65

In view of the above results, especially with regard to *Sagnew gold* and *Vusih gold*, the writer concludes these races are not pure. They show

marked disparity of characters both in the worm and in the cocoon. In order to impress upon the new types *Sagnew gold* and *Vusih gold* certain *relatively constant* characters, the writer intends to employ selection by families. This stability he hopes to bring about by the *separate* breeding of worms of the same family, even under diverse climatic conditions, according to the method advocated by ANDRÉ.

471 - Development of Sericulture in Japan. — *Bulletin de l'Association séricicole du Japon*, 2nd. Year, No. 8, pp. 20-22. Tokyo, 1st. Nov. 1916.

Table I, which summarises the data relating to production of cocoons and the percentages of the 3 harvests, spring, summer and autumn, fort

TABLE I. — *Production of cocoons and crop percentages for the 27 years from 1890-1915.*

Years	Spring cocoons	Summer cocoons	Autumn cocoons	Total	Crop percentages		
					spring	summer	autumn
	hectolitres	hectolitres	hectolitres	hectolitres			
1890	1 549 003	440 777	120 310	2 110 090	73 %	21 %	6 %
1891	2 182 164	506 140	156 128	2 844 432	76	18	6
1892	2 023 600	453 742	187 927	2 665 269	76	17	7
1893	2 205 032	591 464	239 913	3 036 409	72	19	9
1894	2 264 105	673 193	298 818	3 236 116	70	21	9
1895	3 056 045	583 250	425 416	4 064 711	75	14	11
1896	2 491 940	459 788	344 752	3 296 480	75	14	11
1897	2 978 500	491 862	349 137	3 819 499	78	13	9
1898	2 707 832	542 507	398 871	3 649 210	74	15	11
1899	3 275 885	669 856	576 871	4 522 612	72	15	13
1900	3 653 651	679 439	623 935	4 957 025	74	14	12
1901	3 237 610	622 110	687 406	4 547 126	71	14	15
1902	3 194 885	647 590	746 129	4 588 604	70	14	16
1903	3 040 975	682 015	1 000 440	4 723 430	64	15	21
1904	3 331 625	703 724	1 050 867	5 086 216	65	14	21
1905	3 189 157	661 811	1 051 031	4 901 999	65	14	21
1906	3 357 002	744 460	1 245 847	5 347 309	63	14	23
1907	4 034 786	844 848	1 342 906	6 222 540	65	14	21
1908	3 969 884	857 434	1 526 985	6 354 303	62	14	24
1909	4 142 349	836 318	1 555 094	6 533 761	63	13	24
1910	4 363 324	905 161	1 753 247	7 021 732	62	13	25
1911	4 611 818	949 351	2 062 354	7 623 523	61	12	27
1912	4 625 676	960 683	2 427 793	8 014 152	57	12	31
1913	4 671 545	961 780	2 631 461	8 264 786	57	12	31
1914	4 687 048	905 510	2 349 472	7 942 030	59	14	27
1915	4 659 645	1 050 700	2 655 025	8 365 370	56	13	31

TABLE II. — *Increase in production of cocoons in Japan from 1906 to 1915.*

Years	Weight of seed incubated	Production of cocoons
	grams	hectolitres
1906 . . . . .	75 051 552	5 347 305
1907 . . . . .	82 190 731	6 222 541
1908 . . . . .	84 448 254	6 354 302
1909 . . . . .	85 253 075	6 533 761
1910 . . . . .	89 717 433	7 021 732
1911 . . . . .	93 790 337	7 623 522
1912 . . . . .	95 213 431	8 014 153
1913 . . . . .	95 655 665	8 264 786
1914 . . . . .	94 458 630	7 942 030
1915 . . . . .	98 861 268	8 365 370

TABLE III. — *Production from crossed races in Japan from 1913 to 1915.*A. — *Number of spring layings.*

Races	1913	1914	1915
European yellows . . . . .	1 737 394	3 314 039	4 997 873
European whites . . . . .	2 917	30 534	156 198
Chinese yellows . . . . .	4 732	10 330	217 469
Chinese whites . . . . .	3 251 502	2 900 380	6 546 889
Hybrid yellows (Europe and Asia) . . . .	8 304 923	13 313 524	13 691 394
Hybrid whites (Europe and Asia) . . . .	—	—	21 247 949
Japan and Chinese crosses . . . . .	5 993 412	6 841 246	15 773 098
Native race . . . . .	191 584 379	171 671 298	166 650 269
<i>Totals</i>	<b>210 879 259</b>	<b>198 081 351</b>	<b>229 261 139</b>

B. — *Number of spring laying \* sheets.*

Races	1913	1914	1915
European yellows . . . . .	2 980	1 260	2 110
European whites . . . . .	—	7	42
Chinese yellows . . . . .	113	—	55
Chinese whites . . . . .	769 932	14 243	13 873
Hybrid yellows (Europe and Asia) . . . .	4 587	6 274	3 192
Hybrid whites (Europe and Asia) . . . .	—	—	3 386
Japan and China crosses . . . . .	52 488	47 254	62 264
Native race . . . . .	1 353 386	1 235 880	1 185 352
<i>Totals</i>	<b>1 490 546</b>	<b>1 304 918</b>	<b>1 276 274</b>

\* 1 laying sheet = 18.54 gr. of silkworm seed.



the past 27 Years, shows that the spring and summer crop percentages tend gradually to diminish, whilst the autumn production steadily rises, very rapidly in fact during recent years.

Table II shows that the production of cocoons has been on the increase since 1906.

Table III shows for 1913, 1914 and 1915, the number of layings and seed sheets from various white or yellow hybrid races which give cocoons of better quality than the native races.

472 - **Carp Breeding in Madagascan Rice Fields** (1). — LEGENDRE, JEAN, in *Comptes-Rendus Hebdomadaires des Séances de l'Académie des Sciences*, Vol. 163, No. 15, pp. 377-378. Paris, October 9, 1916.

In view of the readiness with which certain fish feed upon mosquito larvae, the writer advocates the breeding of fish in rice fields in order to combat malaria.

The fish best adapted to the warm, still waters of rice fields are members of the Carp family (*Cyprinidae*).

Acclimatisation and breeding experiments have been carried out near Tananarive (Madagascar). In part they have been conducted with native species, in part with mirror carp from France and MAILLART carp from Reunion.

While awaiting the results of these experiments the writer has demonstrated that the Chinese carp, which already existed in the Colony, breed and develop rapidly in the rice fields and devour the greater part of the larvae which live in the waters.

The eggs are laid upon the submerged portions of the rice plant and thanks to the biological conditions of the environment, the fry develop at a surprising rate: 1300 of these fish (weighing altogether about 6 kg.) introduced into a rice field, gave, in 5 months, 18 000 fish (120 kg.). These figures give an idea of the importance this fish breeding in rice fields may acquire. The writer calculates that Madagascar is capable of producing 35 000 tons of fish.

## FARM ENGINEERING.

473 - **The Comparative Costs of Using Agricultural Machinery in the United States and in France.** — RINGELMANN, MAX, in *Journal d'Agriculture pratique*, Year 81, No. 1, pp. 18-20. No. 2, pp. 29-30. Paris, January 11 and 25, 1917.

To supply information to a number of persons wishing to undertake certain agricultural operations, the writer ascertained the average cost of using various machines, using as a basis an inquiry made by Mr. H. H. MOWRY amongst the farmers in the west of New York State (2).

AGRICULTURAL  
MACHINERY  
AND  
IMPLEMENTS

(1) See also, in B. 1916, pp. 1376-1379; Dr. F. SUPINO's paper: *Carp-breeding in Italian Rice Fields*. (Ed.).

(2) Results published in the *United States Department of Agriculture, Bulletin* No. 338, p. 24, summarised in B, 1916, No. 1110. (Ed.).

In Table I are summarised the conditions of use resulting from the average figures obtained in the inquiry, the life of the machine and the total surface they worked during their working life on the farm being shown in round figures.

TABLE I. — *Life and work of agricultural machinery.*

Machines	Average number of working days per year	Life of the machine		Area worked	
		Number of years	Total-days of work	Per year	Total
				acres	acres
Stilt plough . . . . .	19.2	11.7	225	32.52	329
Seat plough . . . . .	14.7	8.1	119	30.54	247
Pulveriser . . . . .	4.2	13.0	55	34.79	452
Spring-time harrow . . . . .	6.6	11.0	73	70.28	1465
Tooth-harrow . . . . .	3.1	14.0	44	47.72	670
Roller . . . . .	4.7	16.0	76	65.14	1043
Cereal drill . . . . .	4.6	16.4	76	45.76	751
1 row hoe . . . . .	4.1	14.0	58	16.70	235
2 row hoe . . . . .	5.6	12.5	70	38.84	488
Mower . . . . .	3.1	14.8	46	27.78	410
Hay-maker . . . . .	1.5	14.0	21	21.35	298
Horse rake . . . . .	2.6	14.5	38	42.50	618
Harvester and binder . . . . .	3.4	15.4	53	34.79	536

In France one plough is sufficient for 40 acres of land, or for about 17 acres of arable land or, again, for about 12 acres of land cultivated every year. On the other hand, under intensive cultivation, an average minimum of 1.6 acres of cultivation is done per acre per annum; therefore, with one plough for about every 17 acres, it would have to cover an average surface of 28 acres a year, which is close to the figures given in the American inquiry (30.39 and 32.37 acres covered per plough per year).

Some time before the war, the writer showed that it paid to use a combined harvester and binder when there were at least 25 acres of cereals to cut (*Journal d'Agriculture pratique*, 1901, Vol. I, No. 16, p. 506; 1904, Vol. II, No. 21, p. 144).

As regards the average area per harvester and binder as used in France, though accurate figures are wanting, they vary from 62 to 175 acres of cereals per machine.

Allowing for the fact that the sale price of agricultural machinery is less in America than in France, the writer has calculated the cost of upkeep per 100 shillings of sale price, as shown in Table II.

TABLE II. — *Cost of upkeep of agricultural machinery.*

Machines	Average sale price in the United States	Cost of upkeep per acre worked				
		In United States		per 100 s. of sale price		
		New parts	Repairs	New parts	Repairs	Totals
Stilt plough . . . . .	44 s	1.69 d	3.08 d	0.80 s	1.45 s	2.25 s
Seat plough . . . . .	164	8.47	3.47	1.00	0.41	1.41
Pulveriser . . . . .	111	2.93	0.69	0.55	0.13	0.68
Spring-tine harrow . . . . .	71	1.16	0.58	0.33	0.17	0.50
Tooth-harrow. . . . .	44	0.77	0.39	0.36	0.18	0.54
Roller . . . . .	99	0.39	0.39	0.08	0.08	0.16
Cereal drill . . . . .	297	4.77	1.35	0.33	0.09	0.42
1 row hoe . . . . .	71	1.35	1.04	0.39	0.30	0.69
2 row hoe . . . . .	125	3.27	1.27	0.50	0.20	0.70
Mower . . . . .	164	4.97	2.89	0.60	0.34	0.94
Hay-maker . . . . .	143	5.62	0.96	0.81	0.14	0.95
Horse rake. . . . .	99	1.93	0.42	0.40	0.09	0.49
Harvester and binder. . . . .	515	11.55	2.93	0.46	0.12	0.58

For ploughs, the writer thinks it advisable, in fairly light soil, to change the share in summer, so as to set it 6 or 7 times per acre, at 7d. a time, thus costing 3s. 8d. to 4s. per acre. After September, when the soil is moister, sharpening once for every 3 or 4 acres is sufficient. In 2 months, 5 turn-wrest ploughs cost over 63 shillings for sharpening the shares. The share is worn out after ploughing 45 acres, and an new one of ordinary steel costs about 6 shillings, i. e. about three half-pence per acre. A hardened steel share costs over 10 shillings, but lasts much longer; but it is liable to break in stony ground if not carefully made.

These prices are pre-war, and compared with those of Table II they enable the American figures to be accepted as general averages.

As regards other costs the writer has not used the American work as a basis, for it only provides for a low rate of interest on the capital invested and on the average area worked each year by each machine as shown in Table I.

The writer admits: interest at 5 %; depreciation at 5 % for 10 years, which is equal to 12.9 %; plus 2 % to cover various expenses and risks; so that the calculation is based on 15 % of the buying price and on a minimum number of acres worked annually in France by the different machines; to these costs are added those of upkeep and the totals representing the costs of using the various machines per acre worked and per 100 shillings of price of the machine (see Table III).



TABLE III. — *Cost of using agricultural machinery.*

Machines	Expenses per acre worked per 100 shillings of cost price			
	Area worked per year	Interest, depreciation and risk	Maintenance charges	Totals
	acres	shillings	shillings	shillings
Stilt plough . . . . .	25	0.61	0.91	1.52
Seat plough . . . . .	37	0.40	0.57	0.97
Pulveriser . . . . .	25	0.61	0.27	0.88
Spring-tine harrow . . . . .	50	0.30	0.61	0.91
Tooth harrow . . . . .	50	0.30	0.22	0.52
Roller . . . . .	50	0.30	0.65	0.95
Cereal drill . . . . .	62	0.24	0.17	0.41
1 row hoe . . . . .	50	0.30	0.28	0.58
2 row hoe . . . . .	50	0.30	0.28	0.58
Mower . . . . .	62	0.24	0.38	0.62
Hay-maker . . . . .	62	0.24	0.38	0.62
Horse rake . . . . .	62	0.24	0.20	0.44
Harvester and binder . . . . .	62	0.24	0.23	0.47

Under these conditions the hiring price, without profit, should be about 25.6 shillings for the drill and 3.5 shillings for the harvester.

Table III only gives indications as the costs of use per acre decrease as the area increases. This decrease only affects the interest, depreciation, and capital risks, and not the maintenance expenses in relation to the unit of area. As an example, the writer gives the two following examples.

For a seed drill costing 453 shillings, working 62 acres each year, the costs would be 2s. 4d. per acre including 9d. for new parts and 1 1/2d. for various repairs as shown in Table II.

For a combined harvester and binder costing 790s., working 62 acres each year, the costs would be 3s. 9d. per acre, including 1s. 5d. for new parts and 4 1/2d. for various repairs.

474 — **The Comparative Cost of Tractor and Horse Power, in the United States.** — MORRISON, F. L., in *Farm Implement News*, Vol. XXXVIII, No. 6, pp. 43-45. Chicago, February 8, 1917.

To show the economic advantages presented by the tractor, the writer has made this comparison between the costs of keeping horses and a tractor of equal power.

The cost of upkeep of a horse varies very widely. Of late years, the expense has continually increased owing to the higher cost of hay, oats, and labour.

According to the official estimates of the United States Agricultural

Department, the cost of upkeep of a horse that was about 80 dollars a few years ago, had increased to 98 dollars in 1912 and to 129 in 1914. In 1916, the writer reckons the cost to be 167 dollars. Thus the cost of upkeep of a horse has doubled in the last 15 years; in calculating it, the writer has taken into account the interest on capital, depreciation of the animal and harness, food, attendance and shoeing. A ration of 4600 pounds of grain and 6300 pounds of hay per horse per year has been taken as a basis, being figures obtained in an investigation in Minnesota.

On an average 160-acre farm, at least 4 horses are required; the maintenance charge for these horses would be \$ 668.76.

For an 8HP tractor costing \$ 1000, the maintenance charges are:

Interest on investment at 6 % . . . . .	\$	60	
Depreciation and repairs at 20 % . . . . .	\$	200	
20 gallons of kerosene at 7.7 cents per gallon . . . . .	\$	1.54	} per 10 hours work.
1 gallon of oil at 35 cents per gallon . . . . .	\$	0.35	
therefore for 100 working days . . . . .	\$	189.00	
Labour and miscellaneous expenses (not including driver's wages). . . . .	\$	19.87	
Total . . . . .	\$	468.87	

It is seen that the maintenance of an 8 HP tractor costs 200 dollars less than that of 4 horses, which cost about 250 dollars each in the United States. Therefore the cost price is the same in both cases.

As regards the comparative cost of a day's work, some official estimates show that a farm horse works from 700 to 1000 hours a year. Taking the most favourable figure, a horse costs 16.7 cents for each hour of work, the annual cost being \$ 167.19.

A 160-acre farm, which is taken as the economical minimum of size for tractor employment, requires 4 horses for the work; therefore the cost per hour of horse labour amounts to 66.8 cents.

The tractor maintained at an expense of \$ 468.87 for the year, also will work 1000 hours, at a cost of 46.8 cents per hour, or as it is 8 HP, it will cost per horse power only 5.8 cents. This is an advantage in favour of the tractor of nearly 11 cents per horse power hour. In fixing the rate of depreciation the writer reckons it at 20 % of the cost price, for he thinks that the life of a tractor is very limited, whilst he values the depreciation in value of the horses at only 10 %.

475 - **The Ransome Three-Row Ridger.** — *The Implement and Machinery Review*, Vol. 42, No. 503, p. 1238 + 1 fig. London, March 1, 1917.

MESSRS. RANSOMES, SIMS & JEFFRIES, of Ipswich, produce a three-row ridger for potato growers who do not favour the use of a combined cultivator and rider.

The main frame is of steel and is quite rigid when fully expanded. Complete control of the implement is afforded by a simple steerage, and it can be adjusted to cover drills varying from 24 in. to 30 in. apart. The ridger bodies are three in number and are built so as to leave a "sole" in

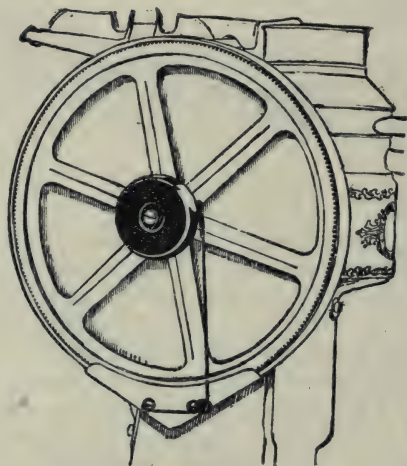
the bottom of the drill, suitable for setting seed potatoes. The steel breasts are adjustable and have chilled cast-iron points.

The machine is a ridger pure and simple, and with it from 8 to 9 acres can be covered in a day when worked with three horses and a man.

476 - Tests of the "Omega" Milking Machine (1) at the Federal Dairy Station at Liebefeld, Switzerland. — See No. 483 of this *Bulletin*.

477 - Speed Indicator for Hand-worked Cream Separators. — *Farm Implement News*, Vol. XXXVIII, No. 8, pp. 29-30. Chicago, Ill. February 22, 1917.

It is generally admitted that the usual speed given to hand-worked cream separators is often too low, being below that indicated by the makers.



Speed Indicator for the DE LAVAL Separators.

Tests at the Purdue Experiment Station showed that the loss of cream due to insufficient speed would amount to a considerable figure.

To avoid this loss, the DE LAVAL separators have been provided with a bell speed-indicator of reliable and simple construction. When the operator begins turning the crank of the separator, the bell rings with a clear, loud note at each revolution of the crank handle, but the moment the machine is running at the proper speed, the bell stops ringing. Should the speed drop below the indicated one, the bell begins to ring again. The device enables the work to be easily controlled.

478 - Brine Tank Refrigerator Cars for Fruit Shipment, Used in Canada. — See No. 489 of this *Bulletin* (with illustration.).

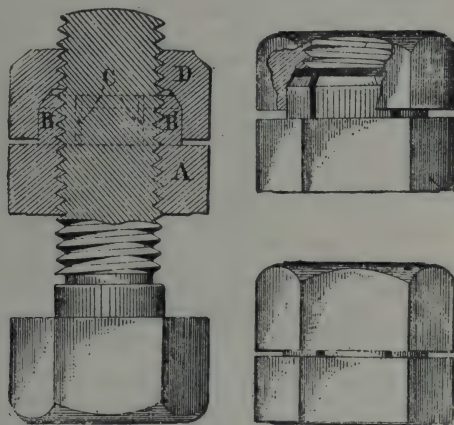
(1) See also B. 1915, No. 212.

(Ed.).



479 - **Lock Nut Made by the Western Screw and Lock Nut Company of San Francisco, United States.** — *Iron Age* October 1916: quoted in *Le Génie Civil*, Vol. I,XX, No. 1805, p. 183. Paris, March 17, 1917.

The nut is made up of the nut itself and its cap. The nut *A* has an annular projection *B* slightly receding towards its upper part and split in 4 parts by two diametrical cuts *C*. The cap *D* is a screw hollowed out below so as to fit on the projection *B*.



Lock Nut made by the "WESTERN SCREW & LOCK NUT COMPANY" of San Francisco.

When the nut is in place and tightened up, the cap is screwed on, down over the projection. The cap, pressing on the 4 parts, clamps them on the thread of the bolt so that the nut is held quite firmly in place.

An advantage of this nut is that it does not strip the threads, as often happens in ordinary nut and bolt combinations.

#### 480 - Review of Patents.

##### *Tillage Machines and Implements.*

France	20 205	Subsoiler for tractor.
	20 246	Apparatus for cultivating between rows of vines.
	20 248	Cultivator for use between vines.
	481 978	Digger.
	482 155	Motor plough for various work in vineyards.
	482 175	Motor balance-plough.
	482 276	GALARDI & PATUZZO motor plough.
	482 296	Improved plough.
	482 434	Pulveriser attachment for ploughs.
Germany	482 444	Tool for use as pick axe, mattock, spade and lever.
	296 182	Hoe with the working parts adjustable with regard to the land wheel.
United Kingdom	15 857 — 103 302	Motor ploughs.

United States	I 212 295	Cultivator shovel.
	I 212 563	Combined weeder and cultivator.
	I 212 695	Device for raising harrows.
	I 212 772 — I 213 336 — I 214 361	Motor ploughs.
	I 212 950 — I 213 050 — I 215 096 — I 215 188	Cultivators.
	I 212 957	Harrow evener.
	I 213 281	Disc harrow.
	I 213 553	Harrow attachment for gang ploughs.
	I 213 842	Ploughing tractor.
	I 214 002	Gang-plough.
	I 214 463	Land-roller.
	I 214 961	Spring-tine harrow.
	I 214 993	Plough.

*Irrigation.*

Germany	296 184	Irrigation device with several spraying-carts connected by flexible tubes.
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*Manures and Manure Distributors.*

Austria	73 189	Manure spreader.
Canada	173 195	Process for manufacturing ammonium sulphate.
France	481 915	Fertiliser made by oxidising the solid residues from sewage waters.
	482 181	Process for treating phosphates.
United Kingdom	15 432	Treatment of feldspar, etc., to render the potassium more available.
	16 558	Process for rendering phosphates citric-soluble.
	16 658	Neutral bacterised-peat manure.
	103 142	Manure made by combining peat with oxidised sewage residue.

*Drills and Sowing Machines, etc.*

Austria	73 190	Potato planter.
	73 191	Seed drill sowing at different depths.
	73 368	Seed drill.
France	482 174	Improved seed-drill.
Germany	296 048	Seed-drill.
United States	I 212 414	Seeding machine.
	I 212 477 — I 212 946 — I 213 411 — I 215 125.	Planters.
	I 213 112 — I 214 577	Maize planters.

*Various Cultural Operations.*

Canada	172 975	Bean clipper.
	173 062	Pruning-knife.
France	481 992	Arrangement for tying up vine-branches.
Germany	295 621	Electrochemical method for treating the soil and the crop.
	296 183	Grafting-knife.
United States	I 213 502	Maize header.

*Control of Diseases and Pests of Plants.*

Canada	173 081 — 173 233 — 173 484	Animal trap.
	173 237	Fly trap.

France	482 008	Apparatus for protecting plants against hail, frost, insects, slugs, birds, mice, etc.
	482 077	Liquid insecticide.
	482 111	Sprayer for treating fungous diseases of the vine, etc.
	482 249	Animal trap.
United Kingdom	16 044	Electrical apparatus for destroying insects.

*Reapers, Mowers and Harvesting Machines.*

Austria	73 184	Reaper
Canada	172 985	Harvester.
	173 413	Binder mechanism.
France	481 912	Improved ear cutter.
	481 940	Teeth for knife bars of mowers and reapers.
	481 964	Side delivery for reapers that can be put in or out of gear.
	482 307	Motor mower.
Germany	295 601	Fore-wheels for harvester.
United Kingdom	103 257	Haysweeps.
United States	1 212 167	Mower attachment.
	212 427	Mowing machine knife bar.
	1 621 244	Seed gatherer.
	1 212 899 — 1 213 151 — 1 214 490	Cotton-pickers.
	1 213 629	Maize harvester.
	1 213 942	Mowing machine.
	1 214 242	Harvesting machine.
	1 214 564	Motor attachment for binders.
	1 214 653	Pea harvester.
	1 214 944	Support for grain-binder engines.
	1 215 191	Grain shocking machine.

*Machines for Lifting Root Crops.*

Germany	295 650	Potato-lifting machine with a wheel or other delivery device
	296 254	Potato-getter with 2 superimposed moving platforms.
United Kingdom	15 817	Potato diggers.
United States	1 212 931 — 1 214 381	Beet-topping machines.

*Threshing and Winnowing Machines.*

Germany	295 787	Straw-trusser and chopper mounted on wheels and adaptable to a thresher.
United States	1 213 101	Seed cleaner and separator

*Machines and Implements for the Preparation and Storage of Grain, Fodder, etc.*

Canada	172 964	Car unloader.
	173 431	Hay rack.
Germany	296 094	Baling machine with needles locked by the piston.
	296 273	Device for binding with iron wire in baling presses, etc.
United Kingdom	16 019	Device for cleaning and sorting fruit.
United States	1 212 273	Portable elevator and wagon dump.
	1 213 056	Maize slicer.
	1 213 158	Hay press.
	1 214 460	Maize cutter.
	1 215 108	Turn table for corn stacking machines.



*Sylviculture.*

Austria 73 369 Receptacle for collecting resin.

*Traction of Agricultural Machinery.*

France 20 249 Agricultural tractors.  
 United Kingdom 15 388 — 16 101 Tractors.  
 United States 1 212 284 Tractor drive-wheel.  
 1 212 525 — 1 212 710 — 1 214 643 — 1 214 673 — 1 215 127 Tractors.  
 1 212 718 Draft-equaliser.  
 1 213 385 Movable tractor draw-bar.  
 1 213 842 Ploughing tractor.  
 1 214 545 General purpose farm tractor.

*Feeding and Housing of Livestock.*

Canada 173 071 — 173 214 Horse-shoes.  
 Germany 295 554 Horse shoe.  
 296 061 Device for tying up cattle.  
 Switzerland 74 711 Device for holding a cow's tail.

*Aviculture.*

Canada 173 053 Egg-tester.  
 United Kingdom 15 679 — 16 033 — 103 141 Devices for supplying corn, etc., to poultry.  
 15 992 Egg-tester.

*Farm Buildings.*

Austria 73 187 Pig-sties.  
 73 188 Partitions for pig-pens.  
 Canada 173 218 Apparatus for removing offal from stable floors.  
 France 482 072 Device for removing warm air from stables, shippens, etc.

*Dairying.*

Canada 173 319 — 173 355 — 173 401 — 173 543 Milking machines.  
 173 361 Teat cup.  
 France 482 281 Combination of a milking machine or the like with a gas engine acting as a pump.  
 United Kingdom 15 903 Butter conditioner.  
 United States 1 212 168 Cream separator  
 1 212 370 Bowl casing drain for cream-separator.

*Various.*

Austria 73 273 Flower-pot.  
 United Kingdom 103 027 Flower-pot with domed re-entrant base provided with drainage holes.

## AGRICULTURAL INDUSTRIES.

481 — **The Potato Starch Industry in Holland.** — GOOSEN, G., in *In-en Uitvoer*, No. 9, pp. 190-192. Amsterdam, February 28, 1917.

The first starch manufactory, established at Foxhol in 1842, was worked by a horse, and could deal with 75 hectolitres of potatoes daily.

After 1860, however, the number of manufacturies began to increase every year. At first the growers could deliver their potatoes at reasonable

prices, but after 1897 all the starch manufactories formed a combine and then bought the potatoes at prices fixed by themselves. The growers, recognising their own interests, then combined together and founded co-operative manufactories.

In 1911, there were 21 private and 13 cooperative manufactories in Holland; in 1916 the former number had decreased to 16 while the latter had increased to 21.

Previous to 1910, it was estimated that the starch manufactories employed 10 million hectolitres of potatoes. In 1915, the area growing potatoes merical increased to 33 324 hectares producing 10 577 147 kg. of potatoes. The manufactories also utilised other than commercial potatoes, for in 1915, they consumed 12 975 000 hectolitres, of which the cooperative works used 66 per cent. As 1 hectolitre of potatoes yields 11 kg. of starch, the world's production of potato starch should reach about 110 million kg. Part of the starch obtained is converted into dextrin and glucose, either by independent factories or by special installations attached to the starch manufactories.

The dextrin produced is in excess of the needs of the country and a large part is exported to the United Kingdom, Belgium, Canada and Spain.

The glucose industry, first established in Holland in 1875, has developed very widely: in 1910 the production was estimated at 20 million kg., practically the whole of which was utilised in the country.

Since the war, the price of potato starch has continually increased. The poor crop in 1916 forced the Government to fix the amount of potatoes to be converted into starch at 8 200 000 hectolitres. The export of starch has therefore decreased, now only reaching 69 400 000 kg.

482 - **The Commercial Use of Saccharose-Inverting Bacteria for the Manufacture of Lactic Acid, Acetic Acid and Acetone.** — MEZZADROLI, G. (Preliminary note), in *Bollettino dell'Associazione delle Industrie dello Zucchero e dell'Alcool*, Year IX, No. 10, pp. 142-145. Bologna, January, 1917.

From 1913 onwards the writer has been working out, at the "R. Stazione de Bieticoltura" of Rovigo (Royal Beet-growing Station), a series of studies and experiments on the utilisation of beet-juice for directly converting the saccharose into lactic acid, as an accessory manufacture by the side of that of alcohol and sugar. A useful solution of the problem has been found in certain bacteria found in sour milk and beet-juice and which have the property of inverting the saccharose before subjecting it to lactic fermentation. The writer has given the provisory names to the bacteria of *bacilli saccaro-invertenti* and these he subdivides into *bacilli invertenti-lattici* (inverting-lactic bacilli) and *bacilli invertenti-acetici* (inverting-acetic bacteria).

Beet-juice containing about 10 per cent of sugar was sterilised for 30 minutes at 120° C. then inoculated with a pure culture of the "inverting-lactic" bacteria and kept at the optimum growth temperature of 36-38° C. At the beginning of the experiment the liquid was brown; after a few hours it became clear, then amber yellow. It was then strongly

acid, and on being neutralised with sterile sodium carbonate the fermentation continues vigorously until a second, third, or even fourth neutralisation is required. The whole of the sodium carbonate may be added at once, for its presence in excess does not in any way affect the fermentation or the final product, lactic acid. Also, in immediately determining the optical rotation of the must, or liquid for fermentation, the writer observed on the first day a decrease of several degrees in the dextro-rotation, which increases so much that on the fourth day, the rotation was about  $+1$ ; then it became  $-1$ , thus changing sign and becoming laevo-rotatory, and then becoming neutral when almost all the sugar had disappeared. The lactic fermentation of the glucose and of the laevulose resulting from the inversion proceed contemporaneously with the action of the bacterial sucrose.

For each 100 gr. of saccharose fermented there is a yield of 60 to 80 % of lactic acid, 10 to 20 % of acetic acid, 1 to 7 % of alcohol, traces of acetone and higher alcohols. The "inverting-lactic bacteria" have constantly given the same results for the three years 1913 to December 1916, when the last experiment was made. Some races lose their power of inverting saccharose if grown for some generations on solid agar media, or alkaline glucose. Others, on the contrary, retain their fermentative powers, provided they are grown again in the same media as those from which they had previously been selected. The same is true for many races of many wild alcoholic ferments that are brought to carry out some industrial process by Mendelian adaptation.

The "inverting-acetic" bacteria are more active than the preceding ones. The yields of acetic acid are not yet higher than those obtained in practice in acetic fermentation; yet it appears quite probable that it may soon be possible to obtain acetic acid directly from saccharose without passing by the intermediate stage of alcohol. With the information obtained and the yields that can be got, the application of this new process depends on the state of the market prices of acetic acid and acetone.

The writer has obtained, from 100 parts of saccharose, 40 to 50 % of acetic acid, 10 to 20 % of lactic acid, 10 to 20 % of ethyl alcohol, and 1 to 2 % of acetone.

The acetic fermentation proceeds more rapidly than the lactic fermentation, with abundant evolution of carbon dioxide, hydrogen, and small amounts of methane.

The aerobic, macerating bacteria of the *asterosporus* type act similarly. The writer has studied one obtained from Prof. CARBONE of the Bologna School of Hygiene, and which has given fair amounts of acetone, but not sufficient to warrant commercial application.

In the course of a more thorough study of these bacteria, it is possible that a type could be found giving larger yields of acetone.

Lactic acid can be changed by oxidation with hydrogen peroxide to acetic acid, and from the latter acetone can be obtained in commercial quantities more easily and at less cost.



Thus, by means of sugar inverting bacteria one can manufacture lactic acid, acetic acid and acetone. The writer also studied a butyric fermentation proceeding from saccharose and giving higher yields than previously obtained in practice and also equal to the calculated theoretical yields (the work proceeding without any reduction and thus without loss of carbohydrates). Unfortunately, the cultures died and it was not possible to obtain fresh ones.

The author proposes to describe in detail in subsequent notes, the biochemical properties and biological behaviour of sugar-inverting bacteria.

483 - The "Omega" Milking Machine and Its Influence on the Yield and Quantity of the Milk: Experiments at the Federal Dairying Station of Liebefeld (Berne), Switzerland. — KÄPPELI, J., The economic importance of mechanical milking and its influence on the milk yield. — in *Annuaire agricole de la Suisse*. Year XVII, Part 1, pp. 167-183, tables and figures. Berne, 1916.

INDUSTRIES  
DEPENDING ON  
ANIMAL  
PRODUCTS

I. — On the proposition of Dr J. KÄPPELI, in charge of investigations on milking machines in Switzerland, it was decided to instal an "Omega" milking machine (1) by OTT BROTHERS, Flen, Sweden in the Liebefeld Dairy Station near Berne in order to investigate mechanical milking.

The installation for 20 cows, including 3 milking machines worked by the ordinary stockmen, can be run by an experienced person assuming that milking does not need to be finished by hand. Without the engine and assuming conditions not requiring long piping in the shippon, an installation would cost approximately:

for 15 to 20 cows, with 2 milking machines, £. 72.

for 40 to 50 cows, with 4 milking machines, £. 100.

These prices are much increased at present.

The experiments were carried out on 12 cows, some having been eliminated for low milk production.

The cows were machine milked successfully the first time and afterwards they were no more disturbed than by hand milking.

The first test was made in order to ascertain the influence of the milking machine on the milk yield. The machine was at first finished by hand stripping and finally operated alone. The writer found a certain decrease in the milk yield when the hand milking was omitted, as the following figures show:

Milk obtained		
Machine milking finished by hand	2167 lbs in 1159	minutes, i. e. 1.87 lbs per minute.
Machine milking alone. . . . .	3278 lbs in 1771.5	minutes, i. e. 1.85 lbs per minute.
<hr/>		
Decrease: 0.02 lbs per minute.		
Hand milking (for comparison). . .	2092 lbs in 1504.5	minutes*, i. e. 1.39 lbs per minute.

\* Including preparing the teats and complete hand milking.

(1) See B., 1915, No. 213 and B., 1916, No. 1022.

(Ed.).

During these experiments, it was found that the milk obtained by mechanical milking was not quite satisfactory from the point of view of purity and cheese making. The makers then so altered the installation as to eliminate this drawback.

From a later series of experiments (hand milking, machine milking finished by hand — machine milking alone), the results of which are given in detail in tables, it appears that mechanical milking, if not finished by hand, causes a decrease in the milk yield, while when finished by hand, the results are similar to those of hand milking.

According to observations by the writer and a veterinary surgeon, mechanical milking had no harmful influence on the udder during the seven months of the experiment.

As incomplete milking may cause a decreased milk yield, hand milking following the use of the machine appears indispensable for all the milking machines at present in use. This fact somewhat detracts from the economy in labour considered as the principal advantage of these machines.

From the tests, the writer has drawn the following conclusions :

1) The "Omega" milking machine works well ; it is comparable if not superior, to the other models.

2) Most cows are easily accustomed to the machine, but all do not allow of complete milking, so that subsequent hand milking can not be neglected without causing a loss of milk.

4) The milking machine has no injurious action on the udder.

5) Carefully conducted hand milking is preferable to the best of milking machines. On the other hand, a good milking machine working well is preferable to a poor milker.

6) For the present, it is not considered advisable to introduce milking-machines into Switzerland. For small farms with 12 to 15 cows, their use does not allow of sufficient economy in labour to warrant the expense of installation and working. Even large farms should prefer hand to machine milking as long as good milkers can be found. In general, practical men prefer hand to machine milking.

484 • **The Simplified Molecular Constant and Its Application to Milk from the Yonne District, France.** — SIROT, M. and JORET, G., in *Annales des Falsifications et des Fraudes*, Nos. 97-98, pp. 425-445. Paris, November-December, 1916.

The simplified constant of molecular concentration established by MM. MATHIEU and FERRÉ (1), seems to the writers, confronted with their own results, to be of great value in researches on the watering of milk.

Numerous investigations have shown that milk serum, secreted under normal conditions, has certain physical constants such as electrical resistance, refractive index, freezing point of crystalloid solutions.

As these constants are not easy to apply practically, MM. MATHIEU and FERRÉ, using as basis the fact, proved by M. PORCHER in 1906, that sodium chloride regulates the osmotic pressure of milk serum and that its

(1) See *Annales des Falsifications et des Fraudes*, No. 63, pp. 12-21 Paris, January 1914.  
(Ed.)

variation is the inverse of that of lactose, which is the most important crystalloid in the serum, have applied the quick and easy estimation of the lactose and chlorides to the investigation of the watering of milk. Having concluded from their observations that "the molecular concentration of lactose + chloride should vary only very slightly", MM. MATHIEU and FERRÉ call the sum of the two the "simplified constant of molecular concentration"; the figure for the chlorides is represented by its isotonic equivalent in lactose; deduced from the molecular depression given by *RAOULT*, the isotonic equivalent of sodium chloride, expressed as hydrated lactose, is 11.9.

The constant per litre of milk would be:  $a + (b \ 11.9)$ , where  $a$  equals the quantity of lactose,  $b$  the quantity of chlorides expressed as sodium chloride.

This constant is brought up to the litre of serum by considering the volume of the insoluble, and it finally gives the true molecular constant expressed by *CMS*.

For 224 samples of milk out of 239 samples examined by MM. MATHIEU and FERRÉ the *CMS* varied from 74 to 79; from this it is concluded that "in 94 % of the samples it was possible to indicate, without fear of error, milk having less than 74 *CMS* as watered, and in addition, no milk however rich, watered to 8 %, would have escaped the test". In pure milk coming direct from the shippin, the constant was never below 74: "a 5 % watering would be detected in most cases".

Finally, MM. MATHIEU and FERRÉ conclude that "once the minimum *CMS* constant has been fixed for a certain product, if the Laboratories for the Repression of Fraud adopt the method, they can ascertain the fact of watering, without any control samples as precisely as with the freezing-point method of M. *STOECKLIN*".

Dr. G. W. *MONNIER* - *WILLIAMS* has studied the *CMS* in various samples: the average value for 44 milks was 74.4, the maximum being 78.1 and the minimum 70.9; out of the 44 samples, 17 had a *CMS* lower than 74, and he concluded that "the results obtained by MATHIEU and FERRÉ are not so good a constant as the solids not fat or the lactose".

To test the value of the MATHIEU and FERRÉ method, the writers carried on observations for over a year on the milk in the Yonne district. The results obtained by them for the *CMS* are shown as follows:

	Minimum	Maximum	Average
Pure milks . . . . .	70.1	80.7	73.5
Normal milks from the Service for the Repression of Fraud .	70.0	78.3	74.2
General results . . . . .	70.0	80.7	73.9

From the general results, it appears that about 30 % of the samples, *i. e.* less than  $\frac{1}{3}$ , have their constant less than the general average of 73.9. The majority have a constant of over 74. As regards differences of breed, feeding, district, the results are not sufficiently numerous to enable their in-



fluence on the *CMS* to be judged, but it should be noticed that the average *CMS* numbers for the different regions are :

Loiret department . . . . .	74.5
Nièvre department . . . . .	73.7
Yonne department . . . . .	73.8

For the milk of 14 "Parthenaise-maraîchines" cows from the Vendée the average *CMS* number was 74.1.

The differences found by Dr MONNIER-WILLIAMS are comparable to those found by the writers, the mean being 74.4.

The averages found by MM. MATHIEU and FERRÉ are not much different from those of the writers, who are of the opinion that so far, for mixed milks, the differences of climate, breed and food do not cause wide variations of the *CMS*.

It should be noted that individuality is of great importance in determining the constants.

As regards the seasons, the authors found :

	Average <i>CMS</i>
Milks in cold season <sup>1</sup> . . . . .	74.0
Milks in warm seasons . . . . .	73.9

The averages are, therefore, the same for the two seasons. No matter what influences may come into play, the *CMS* does not go below 70 ; and any milk giving a figure below this should be considered as watered.

As regards doubtful milks examined by the writers, 40 samples were divided, with the help of the *CMS*, into : 19 watered, 19 natural, 2 doubtful ; that is, in 95 cases out of 100, suspicions would be made certitudes in one way or another. The conclusions arrived at are as follows :

The simplified constant of molecular concentration of milk is not a constant in the absolute sense of the word ; it does not allow, any more than the solids not-fat, of detecting *all* watered milks, as the maxima and minima are too far apart (70-80). However, it is better than the solids-not-fat because : 1) the difference between maxima and minima is less ; 2) there is a clear minimum ; 3) this minimum is close to the average.

The *CMS*, determined along with other constants, will enable the expert to detect watering when the *CMS* is less than 70, even for individual milks. Slight watering of unusually rich milks can, however, pass unnoticed. Yet the *CMS* has not the value of the freezing point ; this without doubt remains the best test for watering, but it is very difficult to carry out.

485 - The Contamination of Milk by Animal Faeces : Experiments in Italy. — DALLA TORRE, C., in *Annuario della R. Stazione Sperimentale di Cascificio di Lodi*. Year 1915, pp. 15-19. Lodi 1916.

Amongst the bacteria in faeces, the majority of which are quite harmless organisms occurring in water, air and on forage. the *coli-aerogenes*

bacteria constitute a group of organisms capable of causing serious harm to the cheese-making industry and of rendering milk undrinkable and even dangerous to the consumer.

The researches carried out by the writer at the Royal Cheese-making Station at Lodi in order to find the number of *coli-aerogenes* bacteria contained in the faeces of cows and pigs, have given the following results :

		In 1 gram of	
		cow dung	pig dung
Number of microorganisms . . . . .		500 million	3400 million
Number of bacteria of the ( . . . . .		1 million	8 million
<i>coli-aerogenes</i> group. . . . .		1.5 million*	4 million*

\* Counts made at another time.

These results show that there are a large number of organisms in dung, more being present in that of the pig than in that of the cow, and that there is a fair proportion of *coli-aerogenes* bacteria, again present in greater numbers in pig-dung than in that of the cow.

In order to show how a small amount of excrement can produce, in milk and in a short time, a large number of gas-producing *coli-aerogenes* bacteria, the following experiment was carried out : a small amount of excrement was introduced into a litre of sterilised milk with a platinum needle ; after well shaking, it was allowed to stand in the laboratory from 12 to 24 hours : then, after a short time the bacterial count was made, giving results as follows :

*Number of coli-aerogenes bacteria found :*

		In 1 cc. of milk	equal to number in 1 litre of milk
After 12 hours . . . . .	2 million		2 milliard
After 24 hours . . . . .	11 million		11 milliard

This experiment shows the danger that may result to the cheese-making industry from the contamination of milk by animal excrement and it confirms the rules of cleanliness so often advised and so little obeyed.

486 - **A Case of Ropy Milk Due to *Bacterium aerogenes*.** — DALLA TORRE, G., in *Annuario della R. Stazione Sperimentale di Caseificio di Lodi*, Year 1915, pp. 23-30. Lodi, 1916.

A serious case of infection due to *Bacterium aerogenes* was observed, in 1915, in the neighbourhood of Piacenza, Italy, in a farm where the milk of the whole herd was perfectly normal after milking, but which, after 10 or 12 hours, became ropy, finally becoming a mucilaginous mass.

The cows were all examined by a veterinary surgeon and were found to be healthy. After the close examination of the shippens, wells, barns, hay-lofts, 7 specimens were taken for bacterial examination, for which lactose agar was used both for plate and slant cultures ; gelatine serum being also used.

The following samples were examined :

Number

- 50 I Ropy morning's milk taken in cans ;  
 50 II Milk of cow No. 2, isolated away from the shippon, but given the ordinary farm fodder ;  
 50 III Milk from cow No. 4, isolated away from the shippon, but given the ordinary farm fodder ;  
 50 IV Well water ;  
 50 V Water from the drinking-trough ;  
 50 VI Half-dry fodder ;  
 50 VII Green fodder.

The day after, there were seen to be little white colonies on the lactose-agar, which drew out into short threads on touching with a platinum needle. Microscopic examination showed the presence of a broad, short, rod-shaped bacterium, non-motile and easily stained. From the characters of this bacterium it was identified with certainty as *Bacterium aerogenes*.

The approximate numbers of bacteria contained in 1cc. of the specimens examined were :

No. 50 I	67 000 000	No. 50 V	10 000 000
No. 50 II	6 000 000	No. 50 VI	2 000 000
No. 50 III	7 000 000	No. 50 VII	3 000 000
No. 50 IV	800 000		

On inoculating the bacterium into sterilised milk, the milk became ropy in 10 hours.

The 2 cows isolated from the shippon, after a sample had been taken, then placed in an uninfected place, gave, owing to the conditions of cleanliness, milk quite normal and in no way ropy. It thus seemed most probable that the trouble was due to a general infection of the water, shippons and hay lofts by *Bacterium aerogenes*.

In such a difficult case it was only possible to advise a thorough disinfection of all the utensils and cans used, as well as of the drinking trough, hay lofts, and especially the shippon, while emphasising the need for strict cleanliness in the dairymen, cows, buildings and utensils.

487 - **Egyptian Milk and Butter.** — GEORGIADES, in *Annales des Falsifications et des Fraudes*, Nos. 99-100, pp. 29-33, Paris, January to February, 1917.

MILKS. — In order to suppress the adulteration of milk, the Egyptian Minister for the Interior asked the Department of Public Health to determine the standard amount of fat and solids not fat which should be present. Taking as a basis the results of analyses made in the Municipal Laboratory of Alexandria, the Public Health Department proposed to fix the following limits :

1) Buffalo's Milk ("Gamousse") :			
Fat . . . . .	5.0 %	Solids not fat . . . . .	8.5 %
2) Cow's Milk :			
Fat . . . . .	4.0 %	Solids not fat . . . . .	8.5 %



In the towns of Egypt not only cow's milk, but more especially buffalo's milk is drunk. The milk of goats, sheep, asses or camels is little used in the towns. The custom of milking the cow before the customer's door, which was once very general, is gradually dying out in Cairo.

It is very difficult to fix a very definite composition for cow and buffalo milk in Egypt as there is a great discrepancy between the averages obtained by different chemists. As a result of investigations made there, the Municipal Laboratory of Alexandria determined to fix limits of 8.5 and 11.0 % for solids not fat. On the other hand PAPEL and HOGAN obtained the following results from the analysis of 61 samples of buffalo milk :

	Minimum	Maximum	Average
Solids not fat . . .	6.05 %	9.75 %	7.95 %
Fat . . . . .	9.4 %	10.4 %	9.95 %

A series of analyses of buffalo milk gave the following results :

	Minimum	Maximum	Average
Fat . . . . .	5.1 %	9.5 %	7.3 %
Solids not fat . .	8.3 %	10.5 %	9.4 %

There is a great difference in the milk yield of the cow and the buffalo.

	Minimum	Maximum	Average
Cow. . . . .	1 oke (1)	3 okes	2 okes
Buffalo . . . . .	1 oke	5 okes	3 okes

**BUTTER:** Fresh butter is very rare in Egypt and few local farms make it; usually it is imported from Europe or Australia. Melted butter, *Samma*, is generally used for cooking. The Arabs use a fat containing a small amount of serum and casein which they call *zibda*. Egyptian butter is sometimes made from cow's milk but more often from buffalo milk (*gammousse*). Butter made from the milk of sheep and goats is also used. This is generally imported from Syria and rarely made locally.

As with milk, it is difficult to fix limits which will prevent the adulteration of butter. The writer proposes that dealers should be obliged to state the animal from whose milk the butter is made.

The characteristics of the fat of buffalo milk are: — A high REICHERT-MESSI number, 32 to 35, or even 38; a refractive index (ZEISS refractometer) of from 41 to 43; a POLENSKE number of from 1.3 to 3.7 and a saponification index between 217 and 235.

488 — “Grana” Cheese Attacked by *Penicillium Roqueforti* at the Cheese Making Station at Lodi, Italy. — DALLA TORRE, G. in the *Annuario della R. Stazione Sperimentale di Caseificio di Lodi*, Year 1915, pp. 20-22. Lodi, 1916.

It is well known that certain species of *Penicillium* cause the characteristic odour, taste and colour of various types of cheese. Thus *Penicillium Roqueforti* (var. of *P. glaucum*) is peculiar to the French Roque-

fort cheese (ewes' milk) and also occurs in the Italian Gorgonzola and the English Stilton. It is also sometimes found in butter kept for a long time in dirty places, which then has the odour of the above cheeses. It can also, together with other moulds, damage certain cheeses with hard or soft rinds, the latter particularly when new and not yet hardened. This has been observed at the Royal Cheese-Making Station at Lodi; where some pieces of "grana" cheese (parmesan) had a surface mould of a greenish white colour, which at first seemed harmless but after a few days attacked the rind and penetrated deeply, being difficult to remove. The cause was found to be *Penicillium Roqueforti*.

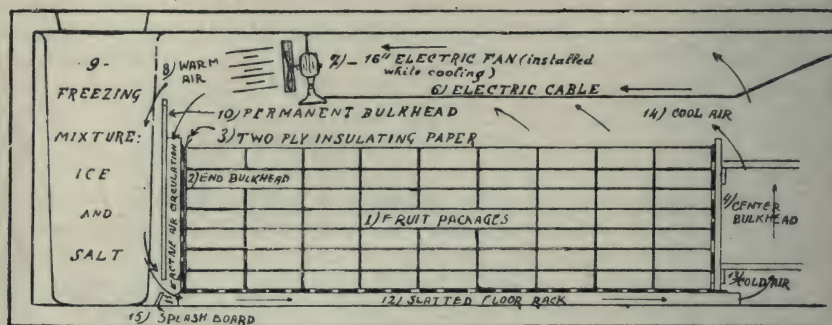
This occurrence, which had not been seen previously at Lodi, was probably due to the wind carrying spores of *Penicillium* from the Gorgonzola store-room, and thus infecting the "grana" cheese, or again, more probably, it was due to infection from utensils or the persons or clothes of the workers.

If the infection had been neglected it could have caused serious damage, but owing to the conditions of cleanliness, it was at once eradicated.

AGRICULTURAL  
PRODUCTS :  
PRESERVING,  
PACKING,  
TRANSPORT,  
TRADE

489 - The Use of Brine Tank Refrigerator Cars for Fruit Shipment. — Dominion of Canada, Department of Agriculture, The Agricultural Gazette of Canada, Vol. 4, No. 2, pp. 110-114, Ottawa, February, 1917.

At the cold storage warehouse of the Dairy and Cold Storage Branch of the Department of Agriculture at Grimsby, Ontario, experiments were



carried out to determine the value of various methods of precooling, packing and shipping tender fruits over long distances. In 1916 the use of the brine tank refrigerator car was carefully studied, and the car was found to be admirable for shipping such perishable goods as poultry, meats, dairy produce and fruits.

During the transit of dressed meat or poultry it was found possible, even in hot weather, to maintain freezing temperature in the car by the continual addition of rock salt to the ice. During the shipment of fruit the use of salt was omitted, because of the supposed danger of freezing, the ice being

put in the tanks in block form. This was found to be a mistake. When the ice is placed in the tanks in large blocks, it only melts when the heat has been transmitted through the iron walls, and rarely descends below 50° F. In order to obtain low temperatures the ice must melt, and to reach this end, salt must be freely added during the whole journey. In the first brine tank trial of shipment between Grimsby and Winnipeg, the fruit was pre-cooled to 43° F. and 500 lbs. of rock salt were added to the ice. During the trip the temperature rose to 53° and the shipment resulted in a heavy loss. A further shipment was made between Grimsby and Brandon. In this case the car was pre-cooled to 39° and 5 % salt added in re-icing. The fruit arrived in splendid condition.

The appended diagram shows a longitudinal section of the refrigerating car. End bulkheads are installed which allowed a 4 inch space between the fruit and the permanent bulkheads in the car. This permitted a free circulation of air to pass from about the cold brine tanks underneath the false floors to the centre of the car to replace the warm air.

This method of refrigeration gives excellent results. Neither freezing nor injury from low temperatures occur with the use of 5 % salt with crushed ice, when slatted floor racks are used so as to assure the free circulation of the cold air.



## PLANT DISEASES

### DISEASES NOT DUE TO PARASITES - OR OF UNKNOWN ORIGIN.

490 - **Effect of the Sirocco upon Tunisian Vineyards, in July 1916.** — *Bulletin de la Direction générale de l'Agriculture, du Commerce et de la Colonisation de la Régence de Tunis*, 20th. Year, No. 89, pp. 199-208, Tunis, 1916.

Up till the 1st. of July, 1916, the Tunisian vineyards were in splendid condition and promised an abundant crop, unfortunately, during the first fortnight of that month there was a sudden rise of temperature and violent gusts of sirocco which caused very serious damage.

A hasty enquiry from a certain number of growers elicited the fact that the damage was very irregularly distributed and that various factors were capable of increasing or diminishing the harmful action of the sirocco. It therefore seemed a useful plan to collect as large a number of observations as possible in order to obtain some future information with regard to means capable of being applied in the future, in order to reduce the damage from sirocco.

Question papers were circulated by the Department of Agriculture among a large number of vine growers : the present paper gives an analysis of the answers received.

It seems to result that the damage is due less to the high temperature than to the insufficient supply of soil moisture in relation to the intense evaporation caused by the warm wind ; some vineyards, indeed, have resisted remarkably well in spite of their having been exposed to the most violent sirocco.

A certain number of natural factors tend to increase the amount of damage : compactness, small depth, white colour of soil, southern exposure. The only thing that can be done is to bear in mind these factors when selecting future sites for plantations.

The observations communicated by the vine growers all agree with regard to the greater resistance of certain stocks.

I. — *Red stocks*. "Alicante". — Resisted very well everywhere ; in many vineyards remained absolutely unharmed ; damage from 0 to

10 %. "Cinsault" — Resistance similar to that of "Alicante"; often unharmed; damage from 0 to 15 %.

"Terret-Bouret" and "Aspiran" — Suffered little.

"Mourvèdre". — Resistance good, somewhat less uniform, however, than for the preceding stocks; damage 5 to 30 %.

"Picpoul". — Resistance fair.

"Carignan". — Resistance fair, varying greatly according to the vineyard: damage from 0 to 15 %.

"Petit Bouchet". — Habitually regarded as resistant, doubtless on account of its earliness. It suffered a great deal in 1916 when the sirocco came earlier; damage sometimes reaches 60 %.

"Alicante-Bouchet". — Suffered badly in almost all the vineyards.

"Aramon" and "Morastel". — Suffered worst, the damage going sometimes as far as the complete scorching of the grapes.

II. — *White stocks*. — In general, suffered more than the red stocks; not one has been recorded as having resisted well.

"Clairette" and Chasselas" have been among the least injured, though, in some vineyards, they lost 50 % of their bunches. "Muscats" "Beldi", "Ugni", "Pedro Ximenes", "Colombar" suffered very badly; a large number of plants have had their bunches completely dried up.

There are some factors which are in the control of the grower. All factors causing the exhaustion of the soil in moisture or nutritive elements (plantations too crowded, adventitious plants, presence of living shade plants) increase the injurious action of the sirocco. On the other hand, all operations which favour the conservation of soil moisture and soil fertility (hoeing, manuring, irrigation) and those which tend to reduce evaporation (particularly the removal of shoots) are of a nature to diminish the damage done by sirocco.

The importance of the damage caused in Tunisian vineyards by the sirocco of July 1916, is undoubtedly largely due to the long spring drought which had impoverished the soil in water. Such a combination of circumstances, without being exceptional in Tunis, rarely occurs with such intensity. It does not seem too rash to believe that the improvement of cultural operations is capable, in normal years, of reducing to an insignificant matter, the danger which the sirocco threatens to the grape harvest of the country.

491 — **Toxic Chlorosis of Maize. The Internal Secretion and Natural Resistance of Higher Plants to Poisons and to Parasitic Diseases** (1). — MAZÉ, P., in *Comptes rendus des séances de la Société de Biologie*, Vol. LXXIX, No. 19, pp. 1059-1066. Paris, 1916.

The writer has been researching for some time past, upon experimentally produced chlorosis of *Zea Mays*.

The disease, unlike the chlorosis observed in plants deprived of sulphur and iron, is due to a more or less secondary intoxication of the plant. Drops of the cell sap and exudate of normal leaves placed upon sick leaves restore the green colour to these latter.

(1) See P. February 1915, No. 226.

(Ed.).

This curious curative property of the cell sap may momentarily disappear under the influence of atmospheric conditions unfavourable to growth. The elaboration of an active sap thus appears as the result of protoplasmic activity which may amount to an actual internal secretion. The rôle of this secretion is to ensure the resistance of the plant to accidental poisoning and parasitic diseases.

The writer gives an account of the facts on which these statements rest.

I. — *The addition of lead to the nutritive solution and also the addition of methyl alcohol produce toxic chlorosis of maize.* — The spring water employed by the writer for the last 20 years for preparing nutritive solutions suddenly became useless for the purpose owing to the occurrence of lead which produced toxic chlorosis.

Lead, in the three following forms and in the following proportions, was introduced into a complete mineral medium A, prepared with distilled water :

1) Lead shot . . . . .	10 gr. per flask of culture medium
2) Litharge . . . . .	2 gr. or 5 gr.
3) Sub-acetate of lead . . . . .	4 cg. or 8 cg.

To the 3 media so obtained two control media were added, the first composed of the medium A, the second of the ordinary mineral medium B prepared with spring water and pure commercial salts.

These 2 control solutions contain :

	Solution A	Solution B
Sodium nitrate . . . . .	0.5 gr	0.5 gr
Monopotassic phosphate . . . . .	0.25 "	0.25 "
Bipotassic phosphate . . . . .	0.25 "	0.25 "
Magnesium sulphate . . . . .	0.1 "	0.1 "
Iron sulphate . . . . .	0.02 "	0.02 "
Manganese chloride . . . . .	0.01 "	0.01 "
Zinc chloride . . . . .	0.01 "	0.01 "
Potassium silicate . . . . .	0.01 "	0.01 "
Aluminium sulphate . . . . .	0.01 "	0.00 "
Sodium borate . . . . .	0.004 "	0.00 "
Sodium fluoride . . . . .	0.002 "	0.00 "
Potassium iodide . . . . .	0.002 "	0.00 "
Calcium carbonate . . . . .	1 "	1 "
Water . . . . .	distilled 1000	spring 1000

Solution A is the complete medium (the composition of which was experimentally determined by the writer) which satisfies the needs of mineral elements and enables it to develop fully.

The 5 solutions described above are put into 2-litre bottles and sterilised at 120° C. The 10 to 12 day old maize seedlings are introduced with the necessary precautions to prevent bacterial contamination.



The writer has observed that the plants which grew in the *A* solution with addition of litharge became chlorotic to the same extent as those which grew in the *B* solution (the spring water of which contained lead). The litharge, though insoluble, had a poisonous effect, owing to its state of division.

The lead shot and the sub-acetate were without action in the conditions of the experiment (the quantity of sub-acetate was too feeble).

The methyl alcohol introduced into the *A* solution at the rate of 1 or 2 parts per 1000, by volume, renders the maize chlorotic. The methyl alcohol disappears progressively from the nutritive solution.

II. — *The deprivation of zinc, and also of manganese, renders the maize chlorotic and the chlorosis observed in these conditions is of the toxic type.* — The writer had already shown that deprivation of manganese rendered the plant chlorotic when it was living in the solution *B* devoid of lead. The deprivation of zinc, on the contrary, caused the death of the plant when its dry weight reached .1. to 2 gr.

The writer took up the question anew, making use of solution *B*., but the elimination of the zinc, instead of entailing the rapid death of the plant, engendered toxic chlorosis in the same way as the privation of manganese. This is easy to understand as the medium *B* is already deprived of aluminium, boron, fluorine and iodine.

Manganese and zinc both ward off, by different methods, the same accident of growth. They protect the plant from being poisoned by preventing the production or accumulation of toxic substances in its tissues.

III. — *Experiments on the treatment of toxic chlorosis.* — The "chlororeaction" (a test in which the exudate of normal leaves or their extract after maceration is allowed to act upon chlorotic leaves in order to restore the green colour to their parenchyma) constitutes a very simple method of testing the curative properties of a substance in relation to toxic chlorosis.

Dilute solutions of zinc or manganese salts are without action, even upon the sickness produced by the suppression of one of them in the nutritive solution; similarly the writer has observed that the "chlororeaction" is negative with the complete solution *A*. It has been noticed, however, that toxic chlorosis may be cured by substituting the medium *A* for the solution which engenders it immediately the first symptoms appear. Delay of a few days, however, renders the operation useless.

The exudate and extract of normal leaves are consequently the only remedies so far known against toxic chlorosis. Under their influence the green colour becomes again evident after only 10 hours exposure to the sun on fine spring or summer days. The chlorophyll increases rapidly and the cured cells reacquire their full activity; they elaborate in their turn the active substances which they pass on to the neighbouring cells; the parenchyma gradually regains its green colour, following the direction of the ascending sap, then in an inverse sense as soon as the green band has reached the extremity of the leaf. To sum up: the transfusion of sap neutralises the toxic substances which the chlorosis engenders and

further, renders the cured cells capable in their turn of preventing their formation or of neutralising their effects.

IV. — *Secretion of the active cell sap.* — It is probable that the property which the parenchymatous cells possess of secreting substances preventive of poisoning is not peculiar to maize but is a general faculty which ensures the natural resistance of the living cell to poisons and to parasitic diseases.

Atmospheric conditions exercise an influence upon the internal secretion: fine weather increases it and the excess of the substances so manufactured escapes to the exterior; dull and rainy days diminish the rate of formation and may even cause the preventive substances to disappear completely from the cell sap. The natural resistance of the plant thus varies with the atmospheric conditions.

V. — *Natural resistance of the higher plants to parasitic diseases.* — The writer infers that the rôle of the internal secretions extends as well to the protection of the plant against fungoid diseases. This inference is based upon the influence which the atmospheric conditions exercise upon the course of these diseases.

It is even probable that this protective function is also used against animal parasites.

492 — **Pea-Nut Mosaic.** — McCLINTOCK, J. A., in *Science*, New Series, Vol. XLV, No. 1150, pp. 47-48. Lancaster, Pa. January 12, 1917.

On September 28, 1915, while looking over a field in which peanuts (*Arachis hypogaea*) had been grown annually for the past six years, the writer observed a plant, of which one shoot bore mottled leaves. A careful inspection of the whole field was made, but no other plant bearing mosaic leaves was found. This made the writer suspect that the trouble was not infectious. It seemed advisable to test this point further, especially since the mosaic plant of *Arachis* was otherwise healthy, except for a few leaf spots produced by *Cercospora personata*.

This mosaic plant was transferred to the greenhouse; before final potting, 2 of the mature pods were removed, and 4 peas taken from them were planted at once in a pot of greenhouse soil.

The 4 resulting plants, together with 2 other seedlings which came up later from peas left on the mosaic plant, have been under observation for the past 5 months. In no case have any signs of mosaic developed. It would thus appear that this mosaic was not carried by the seed.

The original plant continued to grow and produce new leaves at the end of the shoots, but in no case did any but the mosaic shoot produce new leaves affected in the same manner.

To obtain further data of the infectious nature of this mosaic, a pot of 4 peanut plants from a 1914 crop was selected. Two plants were cut with a flamed scalpel to serve as checks. The 2 other plants were treated in the same way, except that into the incisions were inserted bits of macerated mosaic leaflet. These plants have been under observation for the past 5 months, but no signs of mosaic have developed on either the checks or the inoculated individuals.

On October 14, 1915, a pot containing peanut plants from the 1914 seed was taken to the laboratory. By means of Indian ink, circular areas were marked on each leaflet of one plant. Within these circles the tissues were pierced several times with a flamed dissecting needle. This plant served as a check. The second plant in the same pot was treated in a similar way, except that before piercing the leaf tissues, the needle was moistened in the juice from a mosaic leaflet freshly removed from the potted mosaic plant.

Similar checks and inoculations were made on garden peas (*Pisum* spp.) growing in pots, using juice from the mosaic peanut leaflet. On November 13, 1915, the above plants were carefully examined, but neither the checks nor the inoculated plants showed any signs of mosaic on either young or old leaves.

On the same day, in order further to test the infectious nature of this peanut mosaic, one check was prepared by injuring each leaflet of the plant by pinching it between the thumb and finger nail. Eight other plants of the same age and all from the 1914 crops of seed were treated similarly, except that the finger nail was moistened in macerated mosaic leaves before pinching each leaflet to be inoculated.

After more than 3 months after the inoculation, the checks and inoculated plants alike were free from all signs of mosaic. On all the leaves, however, the scars of the finger nail injury were visible.

As the original mosaic plant had matured in the meantime, leaving no fresh leaves to use for inoculation, it seemed advisable to the writer to present this data so that others might be led to record any observation they may make along this line.

## DISEASES DUE TO FUNGI, BACTERIA AND OTHER LOWER PLANTS.

493 - **Bacteria and Fungi in Their Vital Relationships with the Tissues of Plants.** -- See No. 415 of this *Bulletin*

GENERALITIES.

494 - **Observations on the "Oidium" of the Oak.** -- NEGER, F. W., in *Naturwissenschaftliche Zeitschrift für Forst- und Landwirtschaft*, 13th. Year, Nos. 11-12, pp. 544-550, fig. 1-2. Stuttgart, 1915.

In a previous paper on the Oidium of the oak, the writer showed how, in 1914, he had several times infected the pedunculate oak with an Oidium which had developed upon a species of *Rubus*. He admitted, however, that his experiments had not been conducted with all the care that could be wished, as it was possible that among the conidia of the Oidium from the *Rubus* and employed for infecting purposes, there might possibly also have been some of those from the Oidium of the oak. It was therefore necessary to repeat the experiments and to eliminate all source of error.

Preliminary examination showed that the Oidium of the *Rubus* had appeared in 1915, in the same localities (at Pastritzleite between Tharandt and Hainsberg) as in 1914, and at a period (end of June) when the Oi-



dium of the oak had not yet appeared. This fact already proved, to a certain extent, the purity of the conidia employed for infection.

The writer infected, by means of the conidia of the *Oidium* of the *Rubus*, some very young oak shoots, hardly developed, which had been kept for a certain time previously in a moist chamber, in order to exclude chance infection. In other cases, he employed as well some oak seedlings developed under a bell-jar, protected from infection. In every case there was subsequent formation of conidia upon the oak.

In order to eliminate the last remaining possibility of error, the writer grew the *Oidium* of the *Rubus* in pure culture upon the young plants of *Rubus* possessing roots, and later used the conidia so obtained for infection tests. It should be remarked, however, that pure cultures of the *Oidium* of the *Rubus* are difficult to obtain, because the species of *Rubus* to be used is difficult to infect. The conidia of the *Oidium* of the *Rubus* obtained in pure culture were placed, on the 13th. June 1915, upon young cut shoots of the pedunculate oak, in a moist chamber; 4 days later a superficial white mycelium was observed at several points; 2 days later still there was a good formation of conidia. Later experiments have given the same result.

The writer, however, has never been able to infect the young leaves of *Rubus* with the conidia of the *Oidium* of the oak; the cause probably lies in the fact that the *Rubus* is very little susceptible to infection. It has been seen above that it is difficult to infect the *Rubus* with the *Oidium* of the *Rubus* itself; logically therefore it is more difficult still to infect the *Rubus* with the *Oidium* of the oak.

In spite of this, the *Oidium* of the *Rubus* should be identical with the *Oidium* of the oak, seeing that it can be transmitted to this latter tree. This is an interesting point as it had been previously supposed that the *Oidium* of the oak is capable of passing as well to members of the *Rosaceae*. The *Oidium* of the *Rubus*, as well as that of the oak, are said to have appeared in large numbers only during these latter years; this fact, together with the observation that even the fungus of the *Rubus* has only been observed in the conidial form, seem to speak in favour of the identity of the two parasites. Certain observations, however, have shown that these two fungi are quite different. The conidia of the two parasites are distinguished from each other by a constant character: the content of fibrosin bodies. These are found in greater quantity in the *Oidium* of the *Rubus* whilst they are almost completely lacking in the *Oidium* of the oak. The proportion of fibrosin bodies however, is lower for the conidia of the *Rubus* *Oidium* than for those of *Sphaerotheca Castagnei*, which points to the existence of a difference between the *Oidium Ruborum* Rabenhorst — which seems to correspond exactly to the fungus observed by the writer on the *Rubus* — and *Sph. Castagnei*.

How can one explain the apparently contradictory fact that the *Oidium* of the *Rubus* passes to the oak, although it is morphologically different from the *Oidium* of this latter?

The microscopical examination of the conidia which had developed

upon the oak-leaves gave the surprising result that these conidia did not resemble those of the *Oidium* of the oak, but they corresponded exactly with the conidia of *O. Ruborum* (numerous fibrosin bodies, large vacuoles).

This shows that : 1) in favourable conditions it is possible to transmit a fungus to a plant-host which is a stranger to it where it can produce spores; 2) artificial infection experiments may possibly in certain cases give false results by leading one to establish identities which in reality do not exist.

The writer proposes continuing the cultivation of *O. Ruborum* upon the oak in order to determine whether the conidia similarly retain their high content of fibrosin bodies.

In the latter part of his paper the writer deals with his observations upon the *Oidium* of the oak. He has followed (spring 1915), in a wood where the oak *Oidium* appeared every year in a disastrous form the opening of the buds and has established that wintering of the *Oidium* in the buds is relatively rare. However, quite a few of these winter forms are sufficient to enable the fungus to retain its vitality from one summer to another; the great faculty for spreading of the *Oidium* is the reason why it appears every year in the form of an epidemic. It is unable to develop to a great extent upon the first shoots, as one might have expected, as there are not yet any conidia and when these latter are present in any quantity, the leaves of the first shoots have become more resistant owing to the greater cutinisation and modification of the cell contents.

The leaves of the second shoots only form a suitable medium for the fungus 2-3 weeks after the development of the second shoots. During this period, that is to say from the middle to the end of July, the development of the *Oidium* epidemic thus gains in intensity; all these infections are due, however, to conidia carried by the wind and not to infection of the buds. As a factor influencing mass infection there may then enter into play the action of the high temperature and of the intense illumination which occur at this period of the year.

495 - **The Internal Secretion and Natural Resistance of Higher Plants to Parasitic Diseases.** — See No. 491 of this *Bulletin*.

RESISTANT  
PLANTS

496 - **Role of the Awns in the Resistance of Native Hungarian Wheat to Fungoid Diseases.** — See No. 421 of this *Bulletin*.

497 - **Acid and Alkaline Spraying Mixtures.** — HÉRON, G., in *Le Progrès agricole et viticole*, 34th. Year, Vol. LXVII, No. 10, pp. 228-230. Montpellier, March 11, 1917.

MEANS  
OF PREVENTION  
AND CONTROL

With reference to a communication by Messrs. VERMOREL and DANTONY to the French Academy of Agriculture on the preparation of copper mixtures for the control of "mildew", whence it appears that acid spraying mixtures are inferior to alkaline mixtures, the writer — President of the Agricultural Syndicate of the Haute-Garonne — states his personal ideas upon this important subject.

MESSRS. VERMOREL and DANTONY say that acid or neutral mixtures are carried off by rain and atmospheric agents with extreme rapidity, whilst alkaline mixtures resist much better and remain active for months, giving



up after this time a fair quantity of copper to the water of the atmosphere, whence the conclusion that an alkaline mixture with 1 % sulphate of copper would be superior to a 2 % spray, when it is acid. The writer draws attention to the fact that the acid mixture is a mixture which contains the same quantity of lime per hectolitre, in a copper preparation, as does an alkaline mixture to which is added the quantity of copper necessary to render it acid; from the point of view of its physical composition, therefore, it is just as thick.

The writer states that, if the soluble copper is removed by the rain, it would be the same thing from the point of view of the vine as if no excess of copper had been added, consequently the writer is at a loss to understand why this preparation should cease to be active. He states he has obtained good results from acid preparations.

He questions whether the copper, whose disappearance was remarked by Messrs. VILMORIN and DANTONY had not been partially absorbed by the leaves, thus conferring upon them a certain immunity.

It would be interesting to study this phenomenon and, at the same time, enquire whether it would not be possible to protect vines against fungoid parasites by injecting an immunising solution into the sap.

The writer concludes that: 1) thorough spraying with copper mixtures is more important than ever and that such spraying should extend to all the green portions of the plant; 2) in the present state of our knowledge it would be very dangerous, in a year favourable to "mildew", to reduce the quantity of copper.

**498 - Lime-Sulphur Mixtures in the Control of the "Oidium" of the Vine.** — CADORET, ARTHUR, in *Le Progrès agricole et viticole*, 34th. Year, Vol. LXVI, No. 11, pp. 258-259 Montpellier, 1917.

In view of the increase in price of sulphur and of the difficulty of transport, the question of lime-sulphur mixtures is of particular interest in the present circumstances. The writer, who is Director of Agriculture for Cantal, gives the results of his personal researches, carried out chiefly with "Chardonnat" (a residue of the manufacture of artificial silks, containing 60 % sulphur and 30 % of lime).

The action of lime-sulphur mixtures is absolutely certain, even on the "Carignan" varieties. On this stock, 4 or 5 generous treatments (spread in handfuls) have also got the upper hand of the "Oidium" in circumstances where, formerly, the crop was completely ruined. The writer adds that, if preventive treatment is necessary during the flowering period, it is absolutely indispensable to continue it until the last trace of the fungus has disappeared. On the other hand, it is known that the disease is more difficult to combat the nearer one is to the maturation period. The mixtures should therefore be made up as follows:

End May	—	20th. June	—	sulphur . . . . .	50 kg.
			—	lime or wood ash . . .	50 "
20th. June	—	1st. August	—	sulphur . . . . .	60 "
			—	lime or wood ash . . .	40 "



499 - Experiments on the Control of *Stictis Panizzei* ("brusca") and *Cycloconium oleaginum* ("occhio di pavone"), Fungoid Parasites of the Olive Tree, in Italy. — See this *Bulletin*, No. 438.

500 - Patents Relating to the Control of Plant Diseases and Pests. — See this *Bulletin*, No. 480.

501 - Abnormal Leaf Fall in an Hevea observed in Java (1). — ARENS, P., in *Mededeelingen van het Proefstation Malang*, No. 14, pp. 6-11, Soerabaja, 1916.

After a period of heavy rains there was noticed a sudden shedding the young leaves of an Hevea, which the previous day showed nothing abnormal. The surrounding trees showed no anomaly. A few similar cases were observed in other plantations situated in the east of Java.

Small black blotches were observed on the petioles and grey-green patches some centimetres in width upon the leaf blades.

The writer showed these blotches to be due to the presence of a fungus of which various fructification forms are known and which has been described as *Gloeosporium Elasticae* by MASSEE and as *Neozimmermannia Elasticae* by KOORDERS.

Pure cultures of the fungus are easy to obtain but the inoculation experiments carried out by the writer did not always give satisfactory results.

It is considered that climatic conditions must be responsible for creating the necessary predisposition of a tree to the disease. In normal conditions in Java the parasite offers no menace.

It is advisable, however, as a precaution, to treat the trees attacked with a spray such as Bordeaux mixture and to collect and burn the diseased leaves.

502 - *Physalospora Theobromae* n. sp., *Stachylidium Theobromae* n. sp. and *Helminthosporium Theobromae* n. sp., Micromycetes Injurious to Cacao under Glass, at Pavia, Italy. — TURCONI MALUSIO, in *Rendiconti delle sedute della Reale Accademia dei Lincei, Classe di Scienze fisiche, matematiche e naturali*, 5th. series, 1st half-year, 1917, Vol. XXVI, Part I, pp. 75-78; Rome, 1917, *Atti del R. Istituto botanico dell'Università di Pavia*, Series II, Vol. XVII, 8 pp., Plate I, Milan, 1917.

Recently, upon the leaves of a few plants of *Theobroma Cacao* L., cultivated in the glasshouses of the Pavia Botanical Garden, there has been noticed a certain amount of disease of a fungoid nature which, in the present state of our knowledge of the pests of this plant, must be regarded as new.

Upon the infected leaves there are blotches of two distinct forms: some which are marginal and more numerous, are large and of irregular shape; the others, localised in the more central portion of the leaf, are either round or oblong and measure 1 to 3 cm. in diameter. In both cases the blotches upon the upper surface of the leaf are of a light nut-brown or ashy-grey colour and have a reddish brown zone around their margins; upon the lower face of the leaf they are of a light chestnut colour which becomes darker and darker towards the edge.

(1) See B. Dec. 1916, No. 1281.

(Ed.).

Upon these blotches, especially those upon the upper surface of the leaf there subsequently develop little black spots. The number of these is considerable and they are irregularly distributed, forming the perithecia of a *Spheriaceae* which may be classed in the genus *Physalospora*. The writer describes it as new to science under the name of *Phys. Theobromae*.

Upon these same blotches the writer has almost invariably observed a loose, greyish, thin mould usually more abundant upon the upper than upon the lower surface of the leaf. Microscopical examination has shown this mould to be formed of two different conidial forms, micro and macroconidia. The former predominates upon the upper surface, the latter upon the lower.

On the basis of the characters described by the writer these two forms may be referred to the family of the *Dematiaceae* or, more exactly, one is the microconidial form of the genus *Stachylidium* and the other the macroconidial form of the genus *Helminthosporium*. They form species new to science and may be called *Stachl. Theobromae* and *Helm. Theobromae* respectively.

It is not yet definitely determined whether the two species represent different imperfect stages or whether they are concomitant forms of the new *Physalospora*, which the writer regards as the original agent of the disease of the leaves described above.

503 - *Ascochyta* sp. the Cause of a Disease of Cabbages, in Germany. — VASTERS, JOSEF, in *Deutsche landwirtschaftliche Presse*, 43rd, Year, No. 35, pp. 308-309, Berlin, 1916.

The writer describes a disease of the leaves of cabbage which appeared during 1915 in Germany, especially in the regions of the Lower Rhine. It attacked the different varieties of cabbage, the leaves of which showed regular round blotches of blackish grey colour. The size of the blotches varied considerably, but the diameter did not as a rule exceed the limits of 0.5 — 1.5 cm.

The blotches are covered with the pycnidia of a fungus. These are black, very small, but still visible to the naked eye. The pycnidia are found especially in very large numbers upon the upper surface of the leaf, while they are practically entirely lacking from the lower surface. The writer has only observed two cases where the pycnidia were more numerous upon the lower than upon the upper surface of the leaf. Apparently therefore, sunlight has an influence upon the appearance of the pycnidia. The centre of the blotch is generally rather higher in relation to the surrounding portions of the leaf and it is occasionally somewhat darker in colour.

Under the microscope, the pycnidia appear spherical but sometimes also a little flattened. Their dimensions vary between 70 and 140  $\mu$  — most often between 80 and 100  $\mu$ . The spores formed within the pycnidium are colourless and without uniformity of size and shape. The smallest diameter of the spores varied between 2.5 and 3  $\mu$ .

It results from the writer's experiments that the fungus belongs to the genus *Ascochyta*. The notes of KIRCHNER on *A. Brassicae* agree partly with the observations of the writer. It should be remarked, however, that

KIRCHNER limited himself to making use of the researches of SACCARDO for the description of this fungus, without undertaking any personal investigation. As, according to SACCARDO, *A. Brassicae* appeared particularly in Portugal and as it has not often been recorded in Germany, the writer recommends other experiments upon this subject.

It is the white heart cabbage which is most often attacked and, according to special experiments made, it appears that the different varieties behave differently. The red cabbage was only slightly attacked. The Savoy cabbage was a little less susceptible to the disease than the white. With the Brussels cabbage, damage was insignificant.

The disease usually appeared late when the plants were already well developed. It only appeared upon the white cabbage when the heads were already closed. It is particularly the outer leaves that are attacked later on they fall off. In consequence, the development of the plant is hindered. Another result of the disease is that the cabbage matures too late.

The writer recommends removing the first sick plants that appear from the fields in order to avoid the propagation of spores. This is all the more feasible because the disease appears late, at a time when the cabbage can already be plucked and used in the household.

The practice of a good rotation also gives good results.

504 - *Pestalozzia Briardi* and *Lophionema Chodati* n. sp., Parasites of the Vine and Scots Pine respectively, in Switzerland. — LENDNER, A., in *Bulletin de la Société botanique de Genève*, 2nd. Series, Vol. VIII, Nos. 4-6 (April-June 1916), pp. 181-185. Geneva, Feb. 26, 1917.

I. — At the base of a vine-shoot sent for examination from Satigny (Canton of Geneva) in 1916, the writer has noticed the occurrence of a constricted portion with a brown colouration; examination with a lens showed a number of little black spots, fairly regularly distributed, and which proved to be the pycnidia of a *Pestalozzia*. Sections cut for the microscope showed that the fungus occupies the exterior portions of the bark, provoking physiological troubles which result in the formation of cicatrization tissue. Though it was not possible to discover any mycelial filaments in the deep portions of the bark, it is evident that the fungus acts from a distance and that it is responsible for the cancerous formations noted.

The *Pestalozzia* studied is identical with the *P. monochaetoidea* var. *affinis* described by SACCARDO and BRIARD and found by the latter at Troyes (France) upon dead and cut shoots. The writer considers, however, that the fungus in question cannot be regarded as a simple variety, in view of the fact that *P. monochaetoidea* type form, has been found by ELLIS at Newfield (North America) on the dry branches of *Spiraea*. The *Pestalozzia* however, seem to be for the most part specific parasites. Further, the *P. monochaetoidea* type form possesses conidia smaller than those of the fungus in question. These considerations lead the writer to propose that the fungus discovered by him should be raised to the rank of a definite species, and proposes the name *P. Briardi* Lendner.

This fungus is not frequent. The writer, on visiting the vineyard whence



the sick sample was taken, found no trace of the actual fungus. This is no doubt due not only to the fact that this *Pestalozzia* is relatively rare, but also to the fact that the constriction it causes renders the shoot extremely fragile. In the month of June, when the labourer attaches the runners to the props, the runners may even break, if they are sick, at the point attacked and the vine stock is so freed from the fungus and the broken portion of the shoot. If this parasite became more frequent it would probably be very harmful to vines.

In any case, the record of this *Pestalozzia* is interesting as it was previously unknown, not only in the canton Geneva, but also throughout Switzerland.

II. — In the course of an excursion in the Valais, in 1916, Prof. CHODAT has observed in the forest of Finge, upon the scales of the cones of *Pinus sylvestris*, small black pustules, visible to the naked eye. Microscopical examination showed them to be the perithrecia of a Pyrenomycete which the author describes as a new species, under the name of *Lophionema Chodati*.

505 — **Diseases and Pests of the Common Spruce (*Picea excelsa*) in Darnaway Forest, Scotland.** — WATSON, H., in *Transactions of the Royal Scottish Arhicultural Society*, Vol. XXXI, Part 1, pp. 72-73, Edinburgh 1917.

*Trametes radiciperda* seems to attack the healthiest and best developed specimens of spruce; this fungus is always present in the plantations.

*Chrysomyxa abietis* is found in different localities, but seems confined to old mature trees, or stunted suppressed specimens. Alongside of one of these mature infected spruces a small area was planted 2 years ago with 5 different species of *Picea*, but these have as yet shown no susceptibility to the fungus.

*Lephodermium macrosporum* is somewhat virulent on the needles of a pure spruce crop of 38 years of age. On many of the needles, the conspicuous black perithecia are present; the fungus has been the direct cause of the death of many flourishing trees. During February 1916, numerous perithecia of *Cucurbitaria Piceae* were observed on the buds of a few spruces of about 70 years of age.

Damage to the spruce by insect attack is not found extensively, but *Tortrix tedella* is certainly increasing.

The Scolytidae are represented by *Hylastis palliatus*, *Trypodendron lineatum* and *Cryphalus abietis* which, however, confine their attacks to dying trees.

*Chermes abietis* is very common and attacks both *Picea excelsa* and *P. sitchensis*.

Cones are seldom found without the destructive borings of the larvae of *Tortix strobilella*.

506 — **Diseases and Pests of *Pinus ponderosa* in Oregon, U. S. A.** — See this *Bulletin*, No. 454.

## INJURIOUS INSECTS AND OTHER LOWER ANIMALS.

507 - The "Gramang" Ant (*Plagiolepis longipes*), from the Point of View of its Economic Importance. — VAN DER GOOT, P. in *Mededeelingen van het Proefstation Midden-Java*, N<sup>o</sup>. 22, fig. Batavia, 1916.

GENERALITIES.

In a previous publication (1) the writer has given an account of the biology of the "gramang" ant (*Plagiolepis longipes* Jerd.) in which light was thrown on several obscure points and new facts revealed, particularly those relating to the propagation of the queens. He also gave an account of the relations existing between the "gramang" ant and the development of the scale insect *Lecanium viride*.

From a study of the scale insects on young coffee plants, to some of which the ants had access and others to which access was impossible, the writer was able to demonstrate the favourable action of the ants upon the development of the scales.

In the presence of the ants the scale insects increase more rapidly and are more vigorous, whilst the mortality is considerably lower than in those colonies to which access on the part of the ants is impossible.

The ants, by probing the scale insects, stimulate an earlier and more abundant secretion. The writer sees in this forced secretion the reason for the earlier development of the scale insects, as the latter are obliged to nourish themselves more abundantly in order to replace the nutriment lost through the secretion. This involves in its turn more active propagation. Further, it has been observed that the colonies of scale insects visited by the ants are only rarely infected by a little parasite (*Cheiloneuromyia javensis*) which, in other conditions, is a frequent parasite of scale insects. This immunity is attributed to the incessant patrolling and activity of the ants.

By working out the conditions of life of this ant, the writer has been able to explain its injurious influence in the Java coffee plantations. It remains to be seen whether other ants have a similar injurious action and the writer has directed his attention to *Dolichoderus bituberculatus* which is almost as widely distributed in Java as the "gramang" ant.

For *Dolichoderus* it has been shown that this ant has practically no influence upon the mortality of *Lecanium viride*. The scale insect, however, increases more rapidly in the presence of the ant as it is less exposed to attacks of parasites. The presence of *Dolichoderus* is thus just as harmful in coffee plantations as that of the "gramang" ant. Both play a similar rôle in the biology of the *Lecanium*.

The influence of the ants is described upon the development of *Pseudococcus crotonis* Green upon the cacao.

This *Pseudococcus* forms a bait for *Dolichoderus* in cacao plantations. As this ant defends the fruit of the cacao against the attacks of *Helopeltis*, the presence of the *Dolichoderus* is much appreciated by the planters.

(1) See B, Nov. 1915, No. 1227

(Ed.)

On the other hand, the presence of the "gramang" ants is injurious to the development of the *Pseudococcus*.

The writer attributes this difference to the fact that the "gramang" ant fails to destroy the principal parasite of the *Pseudococcus*, i.e. the *Diplois*, whilst *Dolichoderus* pursues it. It is thus to the interest of planters to attract the *Dolichoderus* to their cacao plantations and at the same time to destroy the "gramang" ant.

The discovery of the unfavourable influence of the "gramang" ant both in coffee and cacao plantations has induced the writer to renew his researches upon the best way of destroying it. It follows from these researches that the method described in his previous publication is the best. It consists in digging holes, filling them with the remains of dry leaves and then covering them up with a layer of earth after the ants have built their nests among them. A few holes are made in the upper layer and a little carbon bisulphide allowed to run through. This destroys the ants rapidly and well, and is the cheapest and best method. As the *Dolichoderus* hardly ever mix with the ants there is no fear of their being destroyed. In this way, only the harmful forms are killed, the beneficial forms remaining.

In the concluding chapter the writer describes his observations on *Lecanium viride* and gives a list of its parasites.

Among these latter are included *Chilocorus menlanophthalmus* Muls. whose ravages among the *Lecanium* are, however, not very serious, in view of their relatively slow development, their feeble propagation and limited appetite. Similarly, *Orcus janthinus* Muls. cannot stem an attack of *Lecanium*.

The writer has reared the parasites obtained from infected scales which he had collected from various trees, such as *Gardenia florida*, *Justicia Betonica*, *Plumeria acutifolia*, *Coffea robusta* and *Citrus Aurantium*.

He obtained 2544 parasites, the species of which were distributed as follows:

<i>Coccophagus bogoriensis</i> Koningsb . . . . .	66.4 %
<i>Myiocnema comperei</i> Ashm. . . . .	15.7
<i>Aneristus ceroplastae</i> How. . . . .	1.9
<i>Coccophagus</i> sp. . . . .	8.6
<i>Cheiloneuromyia javensis</i> Gir. . . . .	0.5
<i>Cristatithorax latiscapus</i> Gir. . . . .	3.8
Undetermined . . . . .	3.1

On nearly all these parasites, the presence of hyperparasites was observed, which sometimes were capable of destroying as many as 55 % of the insects studied.

However, it results from the writer's researches that the parasites enumerated above have not much importance. For the most part their increase is very slow, moreover, they are not very resistant and attack other scale insects for preference. The ants also hinder their action upon *Lecanium*.



508 - **Observations on the Life History of *Agriotes obscurus*, Linn.** — FORD, GEORGE. H., in *The Annals of Applied Biology*, Vol. III, Nos. 2 and 3, pp. 97-115. 2 plates. Cambridge, January 1917.

An account of the life history of the Elater *Agriotes obscurus*, the larva of which, in common with related species, is called the "wireworm". Notes on the biology of the larva are given, together with detailed descriptions of both larva and pupa. The Author concludes that the common wireworm in Cheshire, South Lancashire, and North Staffordshire is the larva of *Agriotes obscurus* Linn. It is suggested that the period of time between the egg and pupation is four, and not five years. Characters are given by means of which the larva of *A. obscurus* may be distinguished from the related species *A. lineatus*.

The natural enemies of this insect are discussed; it is concluded that the common mole (*Talpa europaea*) is of great value in checking the pest, and should not be wantonly destroyed unless increasing in too large numbers. The amount of damage caused by a mole is probably very small in comparison with the amount of good it does. With regard to birds, it is suggested that the Plover (*Vanellus vanellus*), which is wholly beneficial, should be stringently protected. As practically all birds except doves and pigeons feed their young on an animal diet, it is obvious that at nesting time they destroy a large number of insects, amongst which wireworms form a fair proportion of the diet. Plovers, Gulls, Rooks, Jackdaws and Starlings are mentioned as being useful in this respect.

The larva pupates in an earthen cell in the ground, down to one foot deep; the pupal period is about three weeks; the imago remains motionless in the pupal cell for roughly two months, after which it comes to the surface, and hibernates under stones, clods, etc., until the next season. These facts may be of importance for dealing with the pest in practice. The paper concludes by giving a bibliographical list of twenty references.

509 - **Fungi and Bacteria as a Means of Combating Insects Injurious to the Sugar Cane.** — GROENEWEGE, J., in *Archief voor de Suikerindustrie in Nederlandsch-Indie*, Part 5f, pp. 2023-2033. Soerabaja 1916.

MEANS  
OF PREVENTION  
AND CONTROL

Of recent years an attempt has been made to combat the insect pests of the sugar-cane by means of parasitic fungi.

The writer gives an account of the results obtained by GOUGH and ROBE at Trinity, in 1911, and by SPEARE in the Hawaiians in 1912.

In 1914, his attention was drawn to these parasitic fungi by the larvae of *Adoretus compressus*, which were covered by an abundant mycelium. A culture of this fungus showed it to be identical with the *Metarrhizium Anisopliae* described by the writers mentioned.

A pure culture of this fungus was obtained and an attempt made to infect 25 larvae of *Adoretus* by mixing the earth in which the larvae were present with a culture of the fungus upon rice and potato. About a month later two of the larvae were found dead, infected with the fungus.

For another experiment, use was made of the larvae of *Aryctes rhinoceros*. After a month 19 of the 24 larvae subjected to this treatment had succumbed to the disease caused by *Metarrhizium*, and two more

were attacked by the same fungus. The experiments were continued in 1915 with larvae of *Holotrichia helleri*, 40 of which were infected by mixing the earth (previously sterilised) in which they occurred, with cultures of *Metarrhizium*. Five weeks later, 11 larvae had succumbed.

Further experiments resulted in the author finding, after three weeks stay in infected earth, 7 dead larvae, and after twelve days, 12 dead larvae all killed by *Metarrhizium*.

The writer considers that these experiments have sufficiently demonstrated the inefficacy of this method for combating injurious insects. The majority of the larvae were only attacked when they were about to pupate. They had already been able, therefore, to do damage, before they were infected.

Another difficulty is that, even when the larvae have reached this stage, they only succumb in part to the disease caused by *Metarrhizium*. Further, thorough treatment with this fungus would entail considerable expense.

The writer mentions later his experiments with *Aspergillus parasiticus* on *Lecanium sacchari* (= *Pseudococcus calcelariae*). When cultures of this fungus were dusted upon the insects the results obtained were nil. A better result was obtained by whitewashing the insects with the cultures. The results in general were so unsatisfactory and the method so costly that the author did not resume his experiments, in view moreover, of the fact that the damage done by these insect to the canes is not considerable.

On studying the larvae of *Adoretus* which succumbed to the disease caused by *Metarrhizium*, the writer found several larvae attacked by another disease of bacterial origin.

A bacillus was isolated 10-15  $\mu$  in length and 1.5-2  $\mu$  broad, to which was given the name *Bacterium gigas* n. sp. This bacterium forms reddish brown pigmented colonies upon agar-agar, is aerobic and resists mannite, levulose, galactose, maltose, saccharose, raffinose and dextrin in the presence of 0.05 %  $K_2HPO_4$  and 0.1 %  $NH_4Cl$ .

On another occasion, from a larva of *Adoretus*, another bacterium, *B. prodigiosum* was isolated.

Experiments have been made on infecting the larvae of *Adoretus* with these 2 bacteria by mixing a pure culture with the earth in which the larvae were buried. The percentage of dead larvae was so small that the writer concluded they were only infected under special conditions. From the results obtained there seems little likelihood of finding a method of fighting insect pests by means of bacterial parasites.

510 - Experiments on the Infection of Insects with the Fungus *Metarrhizium Anisopliae* (1). — RUGGERS, A. A. L., in *Mededeelingen van het Laboratorium voor Plantenziekten*, No. 25, pp. Batavia, 1916.

The writer's present experiments were suggested by the results obtained by RÖRER in 1913, at Trinity Island in the control of Rhyncotes

(1) See on this subject *B. Feb.* 1911, N. 650; *B. Sept.* 1914, No. 689; *B. Oct.* 1915, No. 1107; *B. Dec.* 1915, No. 1358; *B. Dec.* 1916, No. 1341; *B. April* 1917, No. 395. (Ed.).

injurious to the sugarcane. For infection purposes spores were employed obtained from a culture on rice mixed with a double quantity of flour.

The *Metarrhizium Anisopliae* (Metschn.) Sorokin was obtained from Hawaii. The majority of the experiments were made at Buitenzorg (Java), with the larvae of *Leucophilus rorida* and locusts (*Cyrtacanthacris nigricornis*). In one of the experiments the mortality of the locusts owing to infection from *Metarrhizium* reached 80 %. However, on taking into account the results of other experiments, one is led to conclude that such good results are only obtained when the conditions — and particularly the moisture — of the surrounding atmosphere are favourable.

The mortality in the remaining experiments was very slight. As it has been proved that the result of infection, even in a cage where the insects are unable to escape and are in intimate contact with a large number of spores, depends mainly upon the external conditions, the writer concludes that the result of infection in the field depends chiefly upon such conditions. When these conditions are unfavourable to the insects the pest is soon checked without human intervention.

During the rainy season of 1915-1916, the locusts increased enormously in numbers in the centre of the Island of Java (2). In January locusts were found infected with *Metarrhizium*. As a result of the January and February rains, the locusts, died off "en masse" and the pest vanished completely.

The effect of the climatic conditions was so radical that in mid-February the writer was unable to find a single living locust wherewith to continue his researches.

*Metarrhizium Anisopliae* is found on a quantity of insects in Java. Nevertheless, these insects, which are exposed to infection by it multiply to such an extent as to cause considerable damage. From these observations alone it might be inferred that *Metarrhizium Anisopliae* is a dangerous parasite only in special conditions. The writer's researches have proved this supposition to be well founded.

511 - **Partial Sterilisation of the Soil as a means of Freeing it from Injurious Insects and Fungi.** — See p. 676 of this *Bulletin*.

512 - ***Bibio abbreviatus*, a Dipteron Injurious to Celery in Alberta, Canada.** — STRICKLAND, E. H., in *The Agricultural Gazette of Canada*, Vol. 3, No. 7, pp. 600-603, Fig. 1-3. Ottawa 1916.

In the autumn of 1913 and of 1914, a large percentage of the celery plants grown on the Dominion Experiment Station at Lethbridge, Alta, were found to have been damaged extensively by the larvae of the "March Fly" (*Bibio abbreviatus*).

This appears to be an exceptional feeding habit of these larvae, which live for the most part on decaying matter.

As regards the damage to the celery, it was found that a great number of larvae swarmed around the infested plants, so that the whole of the por-

INSECTS  
INJURIOUS  
TO VARIOUS  
CROPS

(2) See B. Dec. 1916, No. 1341.



tion below ground might be affected. Towards the base of the plant, damage is most severe, and the excavations are often confluent. Rarely, the larvae burrow deeply into the pulp, thus forming small tunnels. Usually, however, feeding is superficial and apparently not very localised, for small damaged spots occur all over the part of the plant which is below ground, and only at the base, where the plant is most tender, do the larvae appear to feed continuously in one place. The central stems were not injured.

The attacked areas turn brown during the late summer and autumn and are the seat of infection for various fungous diseases and for the larvae of other diptera, such as *Drosophila*, which soon render the plants unfit for the market.

As regards the cause of the damage, the celery beds had been heavily manured and it is on this manure that the larvae live, and in the majority of cases, mature. When, however, the celery is earthed up, to bleach, in August, many of the larvae of the dipteron are brought into contact with the pulpy flesh of the stalks, and apparently prefer it to their normal food.

Since the damage is to a large extent incidental to this method of bleaching celery, it is desirable to avoid it in places where *Bibio* larvae occur in large numbers. Methods of bleaching celery between boards, or prepared paper, have been adopted at the Lethbridge Experiment Station. It was found that where these were materials employed, the celery did not suffer to any appreciable extent, and the results were satisfactory from a horticultural standpoint.

The writer gives all the data at present known regarding the life-history of *Bibio abbreviatus*, and also a morphological description of the larvae and pupae.

513 - ***Ceratitis cosyra* and *C. capitata*, Diptera Injurious to Fruit Trees in South Africa.** — LOUNDSBURY, C. P., in *The Agricultural Journal of South Africa*, Vol. IV, No. 24, pp. 180-181, 1 Coloured Plate. Johannesburg, December 1916.

Although there are a large number of "fruit flies" in South Africa, practically all the damage done by such insects to cultivated fruit trees is the work of *Ceratitis cosyra* and *C. capitata*.

The first of these diptera is common in Natal, and the second in the Cape Province. Both species occur in the Transvaal, but *C. capitata* is usually much the more abundant.

After giving an account of the life-history of these parasites, the writer adds that many of the larvae are captured by predaceous insects when they fall to ground in order to pupate in the soil.

Until MR. C. W. MALLY, now the Cape Province Entomologist, conclusively proved the value of the poison bait remedy (which consists of a light sprinkling of sugar water poisoned with arsenate of lead), eight or nine years ago, the only reliable remedy for fruit flies was to enclose the fruit, or the tree as a whole, in netting.

In one year, 1898, 20 000 yards of cheap cotton netting, imported at a cost of about a penny a square yard, were sold to Cape fruit-growers.

The poison bait remedy is now much used in the Cape Province, and though it has to be repeated at short intervals in the Transvaal, owing to

the frequency of summer rains, it is a means by which the fruit fly pest can be suppressed even in gardens surrounded by others where this insect is rampant. It is desirable to begin baiting early in the season, but even if it is done late (in December), it should suffice to protect most of the fruit that ripens in February, or later.

514 - **Insects Injurious to the Spruce in Darnaway Forest, Scotland.** — See this *Bulletin*, No. 505.

515 - ***Hylastes cunicularius*, Er. and Its Relation to the Forest in Scotland.** —

MUNRO, JAMES, W. in *Transactions of the Royal Scottish Arboricultural Society*, Vol. XXXI, Part I, pp. 25-30. 1 Pl. Edinburgh, January 1917.

Three species of *Hylastes* attack forest trees in Scotland, *H. ater*, Pk, *H. palliatus*, Gyll. and *H. cunicularius*, Er. The first two have long been known as some of the commonest bark beetles of these forests. *H. cunicularius*, on the other hand, has hitherto been overlooked, probably owing to its close resemblance to *H. ater*.

Of the habits and life-histories of all three species of *Hylastes* our knowledge is scanty and is largely derived from German scientific literature.

Owing to the fact, however, that Scottish forest conditions are markedly different from those prevailing on the Continent, it is essential to study our forest insects afresh from that aspect.

In the present articles, the writer deals with observations made upon *H. cunicularius* under the natural conditions of Scotland.

The material for the comparison of *H. cunicularius* with its congeners is based, partly on specimens taken at Skene (Aberdeenshire) in 1914, and partly on specimens collected on Darnhall Estate (Peebleshire) during 1915-1916. The materials for the illustration of the life-history and of the injuries caused used to young plantations by *H. cunicularius* were obtained on Darnhall.

The writer describes the adult insect, the egg, larva, brood galleries and the pupa. By his researches it has been established that *H. cunicularius* undoubtedly breeds in Scotland, and it may prove to be more common than is at present supposed. It is essentially a spruce-dweller, breeding below soil level, and it feeds in the roots in which it was reared. If, however, opportunity offers, *H. cunicularius* migrates to young coniferous plantations where it feeds on spruce, Scots pine and larch.

Its life-history and habits are strikingly similar to those of *H. ater*, Pk., but owing to the branching of the roots of its breeding host, the spruce, it is probably a more formidable enemy of young trees planted in old spruce clearings than *H. ater* proves in similar pine clearings.

In the larval stage, *H. cunicularius* is harmless. The adult, on the other hand, injures, or totally destroys, newly-planted conifers of various kinds. Spruce, Scots pine and larch have been found attacked by it.

In the areas under the writer's observation, the loss caused by *H. cunicularius* may be stated as not less than a pound per acre, allowing the cost of planting to be three pounds per acre, a low estimate.

## INJURIOUS VERTEBRATES.

516 - **The Squirrel as an Enemy of Forest Plants and of Birds.** — D'ANNE, in *Bulletin de la Ligue française pour la protection des oiseaux*. — Abstracted in the *Revue des eaux et forêts*, 5th. Series, 15th. Year, Vol. IV. No. 1, p. 27, Paris, January 1, 1917.

M. d'Anne has made out a most damaging case against the squirrel. He concludes from his observations that these rodents are great destroyers of birds. He has seen them disturbing birds while building their nests, destroying and knocking down the finished nests, chasing both laying and sitting birds, breaking eggs, killing the young. They attack not only the small *Passeres* but also jays, magpies and hawks (these of more combative temperatment, however). They steal the food of pheasants and even visit dove-cots and the poultry yards. In the Somme, where squirrels were unknown or rare, birds were very numerous up to recent years but with the advent of these rodents the birds diminished in number and have now nearly disappeared. If one adds to all these misdeeds the fact that the squirrel attacks both deciduous, especially the poplar, and coniferous trees, one cannot do better than support the recommendation made to the Society of French Agriculturists that the squirrel be regarded as a pest and its destruction encompassed by landowners and farmers upon their lands. at all times, even by the use of guns.



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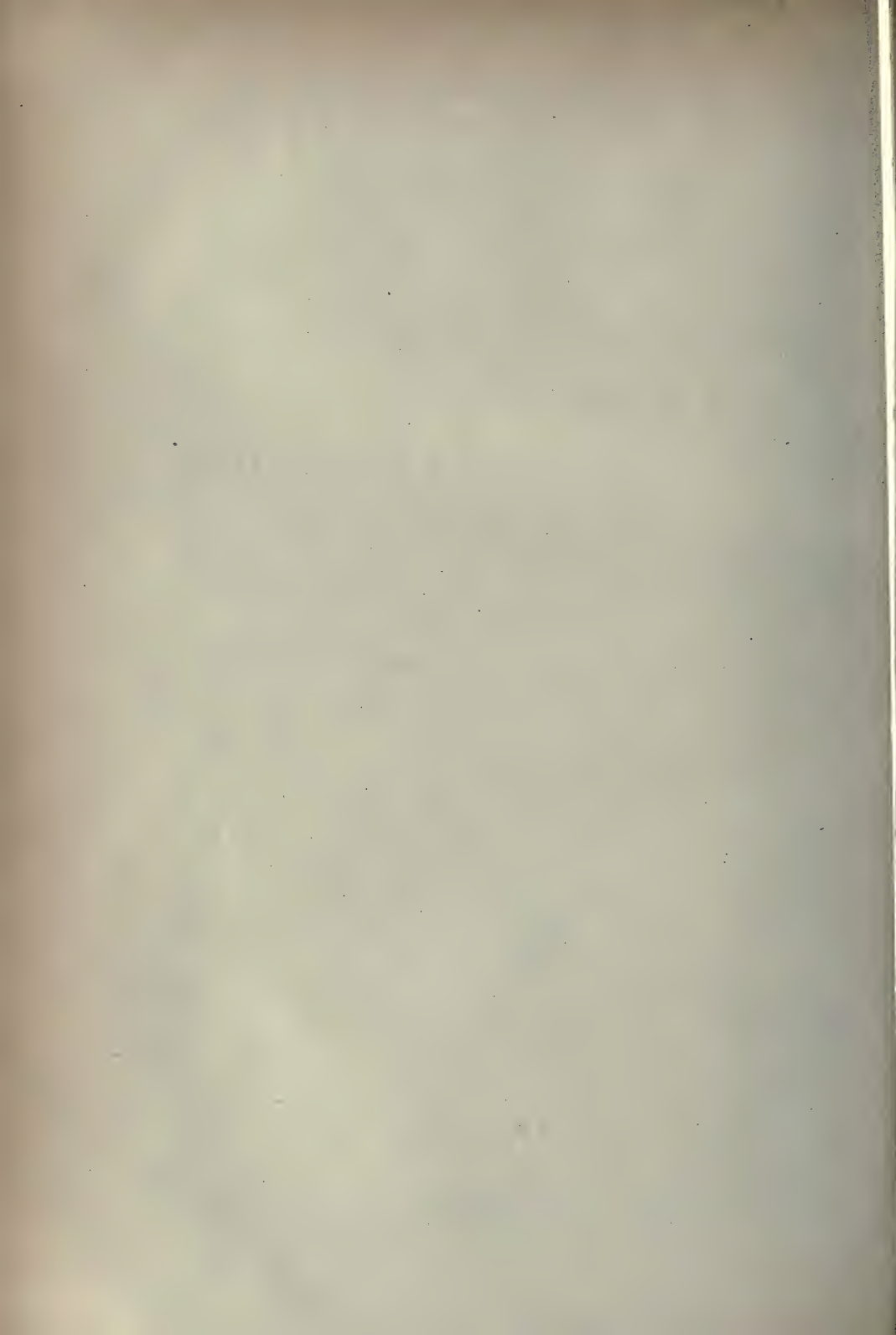
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# FIRST PART.

## ORIGINAL ARTICLES

### Horse-breeding in the Argentine Republic at the Present Day

by

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The results of the last census of livestock in the Argentine Republic are not yet known, while awaiting their publication, however, we may quote the following figures from the 1908 census : — 7 531 376 horses — 285 086 donkeys — 465 037 mules. Further, the recent census of livestock being complete, at least for the province of Buenos Aires, a comparison may be drawn for this important region between the 1908 and 1916 figures relating to the same animals.

	1908	1916	Increase
Horses . . . . .	2 519 953	3 344 554	824 601
Donkeys . . . . .	4 344	7 284	2 900
Mules . . . . .	14 469	19 341	4 872

The number of equines has thus increased considerably: more than  $\frac{1}{3}$  in a period of 8 years ; if the proportion for the remaining regions of the Argentine is the same, the country as a whole should possess more than 9 million of these animals.

HISTORICAL. — In the Argentine, as is well known, the horse owes its origin to a few animals abandoned by don PEDRO DE MENDOZA two years after the foundation of Buenos-Aires (1537) and to those imported, a few years after, from Peru, Paraguay and Chili. The possibility of a type existing before Columbus, and descended directly from *Equus rectidens*, though often discussed and recognised to be plausible, has not yet been sufficiently proved.

The horses imported originally by the Spaniards were of the Andalusian type; as a result of unchecked multiplication in the boundless pampa they gave rise to those innumerable semi-wild herds known as *cimarrones* or *baguales* (1) which made such an impression upon the first writers who dealt with la Plata. So arose the *criolla* or creole race of primitive and hardy animals of which, for long years, man did not take the slightest care, allowing them to breed in conditions entirely natural and not always favourable. The result was that, as a result of its inadequate size and girth, the frequently excessive reduction of chest and lack of symmetry, the creole horse was obviously incapable of constituting the ideal type, necessary to the country when the general conditions of agriculture and stock-raising began to improve. There undoubtedly occurred, in various places, better built animals, of bigger size and more blood, which if properly selected, might have given good results, but the Argentine breeders usually preferred to have recourse to crossing with breeding animals imported from Europe in their scheme for improving their live stock.

What are the results of this line of conduct and how does horse-breeding stand at the present day? These points we are now about to consider.

IMPORTATIONS. — The importation of horses began to reach a certain importance in the latter half of the 19th. century. Between 1886 to 1914, as many as 13 174 breeding animals were imported and, during the period 1900-1914, the number was 7 130, divided as follows:

English Thoroughbred . . . . .	2712	Shetland . . . . .	65
Percheron . . . . .	1080	Oriental . . . . .	45
Clydesdale . . . . .	729	Pony . . . . .	44
Hackney . . . . .	529	Dutch . . . . .	23
Shire . . . . .	446	Hunter . . . . .	18
Anglo-Norman . . . . .	201	Andalusian . . . . .	17
Yorkshire Coach . . . . .	114	Morgan . . . . .	5
Suffolk . . . . .	69	Various . . . . .	713
		Cross-bred . . . . .	238

Broadly speaking, all the principal races and categories of horses have been introduced into the Argentine, but the following distinctly predominate: English Thoroughbred — Hackney — Percheron — Clydesdale — Shire.

These animals have been used to a limited extent for the breeding of pedigree animals, but much more widely for crossing with the local breeds, which has given rise to a fairly considerable number of cross-breds. Table I gives the numbers of stud animals now inscribed in the Stud Book of the "Sociedad Rural Argentina".

(1) The names given to animals which have reverted to the wild state. (Ed.).

TABLE I. — *Distribution of the 19 389 horses entered in the Stud Book of the "Sociedad Rural Argentina".*

	Buenos-Aires	Cordoba	Santa Fé	Entre Rios	Pampa
Percherons . . . . .	5 171	353	187	—	25
Clydesdales . . . . .	3 887	414	55	—	216
Shires . . . . .	3 135	64	248	—	48
Suffolks . . . . .	419	—	—	—	1
Boulonnais . . . . .	240	—	35	—	—
Belgian . . . . .	71	—	—	—	—
Hackneys . . . . .	2 496	345	180	9	3
Yorkshires . . . . .	567	—	—	—	—
Anglo-Normans . . . . .	539	71	90	—	—
Orloff . . . . .	167	—	—	—	—
Hunters . . . . .	165	—	—	—	—
Polo Ponies . . . . .	57	19	42	—	—
American Trotters . . . . .	28	—	—	—	—
Holstein . . . . .	10	—	—	—	—
Shetland Ponies . . . . .	9	16	—	—	—
Trakehner . . . . .	1	—	—	—	—
Oldenburg . . . . .	—	—	—	—	16
<i>Totals . . . . .</i>	16 962	1282	837	9	309

PRODUCTION. — The production of pedigree horses is in relation with the number of breeders of this class of animal, i. e. 278, distributed as follows :

Number of Breeders	Breed	Number of Breeders	Breed
80 . . . . .	Percheron	4 . . . . .	Shetland
61 . . . . .	Clydesdale	4 . . . . .	Belgian
36 . . . . .	Shire	3 . . . . .	American Trotter
25 . . . . .	Hackney	5 . . . . .	Hunter
18 . . . . .	Anglo-Norman	2 . . . . .	Oldenburg
10 . . . . .	Boulonnais	1 . . . . .	Trakehnen
9 . . . . .	Polo Pony	1 . . . . .	Orloff
8 . . . . .	Suffolk Punch		

The number of English pedigree stallions and mares now existing in the Argentine is calculated at over 4 300. They are distributed among 200 stables.

In 1908, among crossbreds there were the following :

241 911 . . . . .	Percheron	45 519 . . . . .	Hackneys
220 074 . . . . .	Clydesdales	19 184 . . . . .	Yorkshires
67 700 . . . . .	Anglo-Normans	19 184 . . . . .	Shires

At the present day the numbers are undoubtedly higher.

In order to form a judgment of horse-breeding generally, it will be necessary to examine in turn the different 3 categories i. e. saddle-horses, light draught animals, and cart-horses.



The great majority of horses in the Argentine belong to the first type, as is shown by the census for the Province of Buenos-Aires : Saddle-horses, 573 182 — Light-draught horses, 543 258 — Cart-horses, 167 648.

Many of the saddle and light-draught horses are included under the name of creole horses, which means to say that they are crossbreds of poor blood, seeing that, properly speaking, pure-bred creole horses no longer exist. The number of breeders who boast of possessing *uncontaminated* animals can be counted on the fingers of one's hand, and even in these cases it might sometimes be shown that they have employed (though perhaps only incidentally) imported breeding animals.

In any case, it is certain that the numerous groups of light-draft animals to day still vary in size, weight and conformation. This is the result of a lack of a definite aim in breeding, itself partly due to the deplorable absence of a big export or even a home market. This lack of orientation, as well as the question of prices which, before the war, were far from remunerative, has discouraged many breeders and led them to devote their attention to other aspects of the live-stock industry.

EXPORT. — From 1886 to 1914, the number of horses exported was 358 270 and, during the period 1905-1914, the annual export figures to the neighbouring South American Republics and South Africa, were as follows :

1905 . . . . .	20 435 horses	1910 . . . . .	4 447 horses
1906 . . . . .	8 574	1911 . . . . .	5 934
1907 . . . . .	7 374	1912 . . . . .	12 549
1908 . . . . .	5 082	1913 . . . . .	13 549
1909 . . . . .	4 765	1914 . . . . .	15 882

BREEDING METHODS. — In the Argentine it has too often happened that breeders, either out of their own conviction or for some particular interest, have followed completely opposite methods, some being immense enthusiasts for English thoroughbreds, others for the Hackney, the Anglo-Norman, the Yorkshire Coach, etc. The result is a continual changing of ideas which has inevitably led to the present state of affairs.

The Argentine possesses a considerable number of excellent English thoroughbreds for stud purposes ; the following stallions may be quoted which have either been or are still being used : Flying Tox — Diamond Jubilee — Jardy — Ormonde — Pietermaritzburg — Cyllene — Polar Star. Nor is there a lack of types for crossing, such as Val d'Or. Unfortunately, this magnificent material is devoted entirely to the interests of the turf, very popular in the country. It would, however, have allowed of the formation of a magnificent collection of half-breds adapted to various needs, whereas what actually exists is incomparably less important than what might and undoubtedly will be obtained eventually. In view of these antecedents, there is no room for astonishment if, notwithstanding the large number of horses existing in the country, it is difficult to obtain homogeneous lots of any importance. The admission is not a very satisfactory one to make and yet, in spite of everything, we have faith in

the future of the Argentine in this respect and that for the following reasons :

In order to arouse the energy and latent capacity of breeders a recognised international market is required, one sure of paying good prices and capable of affording a clear index of requirements. After the present world conflagration this market is bound to be established, and there will then ensue a rapid transformation of this branch of animal production. In subsequent articles, treating of the production of cattle and sheep in the Argentine, we shall be able to prove that the existence of a definite and lucrative market has been the direct cause of improvements occurring in the breeding of both these classes of animals. Even with regard to horse-breeding, however, we can cite an example which affords abundant support of the opinion expressed above.

Hitherto the breeding of cart-horses has not been influenced by any idea of an external market but has been obliged to respond to the ever increasing demands of agriculture, industry and trade.

Requirements in the shape of ordinary saddle and light draught animals, army horses, etc., have always been relatively easy to satisfy owing to the large number of horses available relatively to the limited requirements along these lines. On the other hand, with regard to cart-horses, it was a question of building up a type which absolutely did not exist and which must fulfil actual, positive requirements.

A start was thus made, first with Shires and Clydesdales, then with Percherons, and soon the number of pure bred and half bred animals was considerable. At the present time the majority of cart-horses, in the large towns of the Argentine are sound Shire and Clydesdale crosses, heavy animals showing the characteristics of these English breeds.

The turn of the Percherons has come relatively recently and already their success has surpassed that of the Clydesdales. The Percheron, in fact, is the real farm-horse which was wanted. It is the post-horse type which gives the best results : ample in stature and girth, hardy, strong, hardworking, it is adapted equally well both to the slow work of ploughing and to more rapid carting-work, etc. If necessary, it goes well between the shafts of a country conveyance. It has been remarked, besides, that the offspring of crosses between these Percherons and good native mares of sufficient stature and muscle often gave excellent all-round animals, in great favour in the country and also for artillery.

At the exhibitions of the "Sociedad Rural Argentina" and also at provincial shows, one can often admire a really striking collection of these heavy animals. On the other hand, Boulonnais and Belgian horses have not yet found a favourable environment, and the same may be said of the Suffolk Punch.

FEEDING. -- Horse-breeding in the Argentine is characterised by the system of free pasturage. With the exception of valuable pedigree animals, reared in *cabanas* and of horses employed in the large urban centres, all horses live continuously in the open, exposed to the inclemencies of the weather and the vagaries of the seasons. The horses of the first cate-

TABLE II. — *Prices (in paper pesos) of stud animals sold at the exhibition of the "Sociedad Rural Argentina" in 1916.*

Breeds	Animals presented	Animals sold				Prices	
				Minimum	Maximum	Average	
Arabs . . . . .	8	Stallions	7	2	1 200 pesos	1 500 pesos	1 350 pesos
		Mares	1	—	—	—	—
English Thoroughbred	10	Stallions	9	1	500	500	500
		Mares	1	1	600	600	600
Hunter . . . . .	5	Stallions	5	3	850	900	833
Polo Pony . . . . .	5	Stallions	4	2	400	1 100	750
		Mares	1	1	400	400	400
Criolla . . . . .	6	Stallions	6	1	600	600	600
Hackney . . . . .	35	Stallions	28	14	400	1 400	739
		Mares	7	1	400	400	400
Hackney Pony. . . . .	6	Stallions	4	2	450	800	625
		Mares	2	—	—	—	—
Yorkshire . . . . .	8	Stallions	6	5	600	1 400	890
		Mares	2	1	—	—	—
Anglo-Norman. . . . .	2	Stallions	1	1	1 050	1 050	1 050
		Mares	1	—	—	—	—
American trotter. . . . .	1		1	—	—	—	—
Percheron. . . . .	62	Stallions	51	43	350	7 000	1 530
		Mares	11	1	300	300	300
Boulonnais . . . . .	18	Stallions	13	4	1 600	2 000	1 750
		Mares	5	—	—	—	—
Breton . . . . .	3	Stallions	3	—	—	—	—
Suffolk . . . . .	8	Stallions	5	2	1 100	1 300	1 200
		Mares	3	—	—	—	—
Clydesdale. . . . .	35	Stallions	32	23	450	2 000	998
		Mares	3	—	—	—	—
Shire . . . . .	22	Stallions	17	13	900	6 500	1 973
		Mares	5	1	450	450	450

gory are given various rations, almost always including: hay — maize or oats — bran, etc., but the overwhelming majority live exclusively on natural pastures or lucerne. Notwithstanding this free kind of life and feeding, the animals usually remain in good condition and work well, especially where the *pastos* (pastures) are rich and of the *tiernos* (tender) type or in the *alfalfares* (lucerne fields) zone. Speaking from our own experience, we



may say that good Percheron crosses, employed throughout the year on ploughing work, seeding, harvesting and carting grain, etc., and fed exclusively on the lucerne from *potreros* (enclosures) in which they are shut after work, keep in excellent condition and work hard and well.

CARE. -- In the *pampa* horses go unshod, as stones or any other similar obstacles are completely absent, and the hoof wears down very slowly and does not split. The grooming leaves a fair amount to be desired, frequently the only attention given is to put the stallion with a certain number of mares at rutting time. An almost universal character among Argentine horses is their extreme docility once they have been broken in and trained to work.

ENCOURAGEMENT. -- Apart from the prizes offered at race-meetings and country exhibitions, and a certain number of purchases made by the Jockey Club for army purposes, there are no other forms of encouragement worth mentioning.

VALUE OF HORSES. -- As stated above, in normal times prices have never been very good, and consequently many breeders, especially those interested in light-draught and saddle horses, have preferred to relinquish horses and devote themselves to fattening cattle.

Table II shows, in paper *pesos* (1) the price of the breeding animals sold at the exhibition of the "Sociedad Rural Argentina" in 1916.

As regards the value of the common type of horses exported of recent years, this may be estimated as varying around 200 *pesos* per head.

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(1) 1 paper *peso* of the Argentine Republic = 1s. 9d.

(Ed.)

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## SECOND PART. ABSTRACTS

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### AGRICULTURAL INTELLIGENCE

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#### GENERAL INFORMATION.

DEVELOPMENT  
OF  
AGRICULTURE  
IN DIFFERENT  
COUNTRIES

517 - **Agriculture and Stock Breeding in Uruguay.** — Report received from Dr. ENRIQUE JOSÉ ROVIRA, Uruguayan Delegate to the International Institute of Agriculture (extract from a Report by the engineer SOCRATES S. RODRIGUEZ).

**CLIMATE.** — The average annual temperature is  $16.5^{\circ}$  C, and the minimum temperature is rarely as low as  $-1^{\circ}$  or  $-2^{\circ}$ . *Snow* is unknown throughout the country, so that cultivation and grazing can continue during the whole year. The average temperatures for the different seasons and months are: — *summer*  $23.94^{\circ}$  C (December  $21.09^{\circ}$ , January  $22.82^{\circ}$ , February  $22.01^{\circ}$ ); *autumn*  $16.38^{\circ}$  C (March  $20.52^{\circ}$ , April  $16.12^{\circ}$ , May  $12.48^{\circ}$ ); *winter*  $10.18^{\circ}$  C (June  $9.78^{\circ}$ , July  $9.9^{\circ}$ , August  $10.87^{\circ}$ ); *spring*  $15.17^{\circ}$  C (September  $12.28^{\circ}$ , October  $14.69^{\circ}$ , November  $18.53^{\circ}$ ).

The *rains* are a little more frequent in autumn and distributed fairly evenly amongst the other three seasons. The annual fall is normally 895 mm., distributed as follows: *summer* 211.5 mm. (December 77.2 mm.; January 87.6 mm.; February 46.7 mm.); *autumn* 254.2 mm. (March 102.5 mm.; April 85.1 mm.; May 66.6 mm.); *winter* 229.8 mm. (June 66.8 mm.; July 82.5 mm.; August 80.5 mm.); *spring* 200.7 mm. (September 63.4 mm.; October 73.9 mm.; November 63.4 mm.). The number of rainy days is, on the average, 60 a year. The amount of rain which falls at a time is fairly regular, and exceeds 20 mm. in 12 cases only.

The average annual number of *cloudy days* is 52 %, and the average for the four seasons is: — 47 % in summer, 51 % in autumn, 59 % in winter and 52 % in spring.

There are 32 *windy days* annually, when the velocity of the wind varies from 25 to 37 miles an hour, and 6 days on which the velocity exceeds 37 miles an hour. There are very strong winds in every season, especially

in spring. The average annual wind velocity is 6.679 miles an hour, differing little in the various months. The average seasonal velocity is: 6.757 miles an hour in summer; 6.083 miles an hour in autumn; 6.860 miles an hour in winter; 6.932 miles an hour in spring.

The most characteristic feature of the climate of Uruguay is the sudden changes in temperature, which are particularly marked in spring and summer. Variations of from  $8^{\circ}$  to  $10^{\circ}$  in one hour are not infrequent. These rapid variations are caused by the transition from the moderate warm and moist north or north-westerly winds to the more violent and drier strong south or south-easterly winds.

Hail falls, on an average, 5 times a year, 3 times in winter and twice in spring. It is rare in autumn (harvest season) and unknown in summer.

SOIL. — Geologically, the soil of Uruguay consists of primitive rock — granite, porphyry, etc. The agricultural soils are usually strong, of silicious loam, slightly humiferous, rich in organic substances and potash, poor in lime and phosphoric acid. They are usually extremely fertile soils. The following analysis gives some idea of their composition.

*Analysis of a Sample of Soil from Uruguay.*

		Soil	Sub-soil
Physical analysis	Coarse sand . . . . .	784.8 $\frac{0}{100}$	805.8 $\frac{0}{100}$
	Fine sand . . . . .	114.2	117.7
	Clay . . . . .	97.6	66.4
	Organic matter . . . . .	17.6	10.1
Chemical analysis	Nitrogen . . . . .	1.14 $\frac{0}{100}$	0.711 $\frac{0}{100}$
	Total phosphoric acid . . . . .	0.462	0.151
	Assimilable phosphoric acid . . . . .	0.0258	0.0283
	Lime . . . . .	3.516	11.325
	Total potash . . . . .	10.950	11.719
	Assimilable potash . . . . .	0.491	0.389
	Magnesia . . . . .	1.780	0.790

IRRIGATION. — The land is irrigated by a great hydrographic system whose principal arteries are 16 rivers, into which flow numerous tributaries, which, in their turn, are fed by many secondary streams. By its complexity, this network forms an admirable irrigation system naturally composed of 500 water-courses and amply sufficient for the agricultural requirements of the country. Many farms are also supplied with pumping machines worked by wind by which their cisterns and reservoirs may be filled. This precaution is necessary because, during a period of drought, it sometimes, though rarely, happens that the water-courses fall considerably, or are even completely dried up.

WILD VEGETATION. — This is distinguished by the lack of large trees on the low mountains, on the slopes of the hills and in the valleys.

"Espina de la cruz" (*Colletia cruciata*), "coronilla" (*Scutia buxifolia*), "molle" (*Dacrydium deplanatum*), grow amongst the rocks together with: myrtles, "canelón" (*Myrsine* sp.), "sombra de toro" (*Iodina rhombifolia*), "tala" (*Celtis Tala*) and "romerillo" (*Heterothalamus brunioideus*), which are mostly only shrubs.



A styrax (*Styrax leprosum*), many euphorbia of the genera *Croton* and *Sebastiania*, and many other bushy species with small, coriaceous leaves, give the vegetation of the mountain chains of the Minas, Cerro Largo and Tacuarembó departments a very characteristic appearance.

The most common plant of the sandy shores of the Atlantic, continually swept by winds from the south, is *Colletia cruciata*. The above-mentioned shrubs grow amongst the gneiss and granite of the hill sides. In all other soils there is an abundant growth of herbaceous plants — Leguminosae, Compositae, Labiatae, small Graminaceae. The vegetation changes down by the water-courses, where the trees and bushes are always finer and more vigorous.

The Myrtaceae family is represented by more than 40 species belonging to different genera, which are usually found near running water. The most important of these, and those which require most water are: — “sarandí blanco” (*Phyllanthus Sellowianus* = *P. ziziphoides*); “sarandí colorado” (*Cephalanthus Sarandí*); “mata ajo” (*Lucuma Sellowii*); “seibo” (*Erythrina Crista-galli*), which forms forests along some of the rivers.

The other most common plants, in order of importance, are: “laurel blanco” (*Oreodaphne acutifolia*), “coronilla” (*Scutia buxifolia*); “sombra di toro” (*Iodina rhombifolia*), “blanquillos” (*Sebastiania angustifolia* and *S. serrata*), “árbol de la leche” (*Sapium aucuparium* = *Excoecaria biglandulosa*), “palo amarillo” (*Berberis glaucescens*), “timbo”, “rama negra” (*Cassia corymbosa*), an acacia called “aroma” or “espinillo” (*Acacia adenocarpa* = *A. Farnesiana*), “saucedel país” (*Salix Humboldtiana*), “canelón” (*Myrsine* sp), “higuerón” (*Urostigma* sp); these two latter reach gigantic dimensions.

The natural forests, composed of native varieties only, are thick and vigorous, and grow along the banks of the large and small streams. In spite of its many varieties of trees, Uruguay has no real forests suitable for working. The area occupied by natural forests is 1 071 172 acres, and by forests which are cultivated and worked, 88 371 acres.

ECONOMIC AND LEGAL CONDITIONS OF LANDED PROPERTY. — The Government has sold some estates, but, as a rule, it does not sell transferable property to private individuals at the present time. This regulation will hold till the national cadaster is brought to an end.

The mortgage Bank of Uruguay (“Banco hipotecario del Uruguay”) gives great facilities for the purchase of land to be used for agricultural and breeding purposes. It lends (up to  $\frac{1}{3}$  of the appraised value of the landed property) on mortgages quoted at the commercial Exchange of Montevideo. The loans are amortizable in 30 years by monthly payments of 6.85 pesos (1) for each 1 000 pesos advanced (interest, amortization and commission); payment may also be made quarterly or half-yearly. The mortgages may be discharged at any time.

For the purpose of determining their sale price or rent, the natural pasture-lands (campos) are classed as either “very good”, “normal” or “ordinary”. Their sale value varies from 12 to 36 pesos per acre, according to their nature and situation. Meadows quoted at from 12 to 18 pesos, are of the ordinary type, not very uniform, excellent for breeding cattle and sheep, but little suited for fattening-up, and situated at a distance of 112 — 931 miles from the department of Montevideo. The following are the sale prices in the different departments in pesos per acre:

(1) 1 gold peso = 4 s. 3 d. at par.

Artigas . . . . .	12 - 14 pesos	Flores . . . . .	32 - 44 pesos
Tacuarembó . . . . .	12 - 14	Colonia . . . . .	32 - 44
Rivera . . . . .	12 - 14	Roelsa . . . . .	14 - 18
Cerro Largo . . . . .	16 - 20	Maldonado . . . . .	16 - 18
Treinta y Tres . . . . .	16 - 20	Salto . . . . .	14 - 18
San José . . . . .	24 - 40	Paysandú . . . . .	14 - 20
Florida . . . . .	32 - 40	Rio Negro . . . . .	16 - 24
Soriano . . . . .	32 - 40		

The rent of the Government natural pasture land is between 0.50 and 2.80 pesos per acre; that of private pasture, between 0.90 and 2.80 pesos per acre.

The rent corresponds to the price of the grass, which is based on the crop, as shown in Table I.

TABLE I. — *Ratio between: grass crop, price of grass and rent of meadows per acre, in Uruguay.*

Grass crop tons per acre	Rent pesos per acre	Price of grass pesos per metric ton
11 to 1 . . . . .	0.87	0.72
1 - 2 . . . . .	1.02	0.58
2 - 2 $\frac{3}{4}$ . . . . .	1.18	0.42
2 $\frac{3}{4}$ - 3 $\frac{1}{2}$ . . . . .	1.34	0.37
2 $\frac{1}{2}$ - 4 $\frac{1}{4}$ . . . . .	1.49	0.33
4 $\frac{1}{4}$ - 5 . . . . .	1.65	0.31
5 - 6 . . . . .	1.80	0.29
6 - 6 $\frac{3}{4}$ . . . . .	1.96	0.28
6 $\frac{3}{4}$ - 7 $\frac{1}{2}$ . . . . .	2.11	0.27
7 $\frac{1}{2}$ - 8 $\frac{1}{4}$ . . . . .	2.27	0.26
9 $\frac{1}{4}$ - 9 . . . . .	2.42	0.26
9 - 10 . . . . .	2.58	0.25

The majority of leases are for periods of from 4 to 10 years.

In rural districts the land-tax is 4 per thousand of the value of the land, excluding improvements, on property on which the annual income does not exceed 2 500 pesos, in those cases in which the owner possesses no other estate. In all other cases it is 4.5 per thousand. In urban and suburban districts the tax is 6.5 per thousand on the total value of the ground and the improvements.

According to the 1911 census, Uruguay had, at that time, a population of 1 177 560 inhabitants (of which  $\frac{1}{5}$  were of foreign nationality), that is to say 1.7 per square mile. This is a larger population than that of most of the South American States. The census showed that there were 15 534 owners of agricultural estates, 11 924 farmers and 3 950 small farmers. There were 56 560 rural estates, of which 14 873 were stock farms, 25 944 purely agricultural and 15 473 mixed.

*Average cost of labour.*

- 1) "Capataces", or foremen on stock farms: 20 to 10 pesos a month, board and lodging.
- 2) "Peones" (day labourers) not permanent: 0.75 to 1.50 pesos a day; 2 pesos a day if they have their own horse.
- 3) Mechanics: from 1.50 to 2 pesos a day.
- 4) Mechanics for mechanical cultivation: 50 to 60 pesos a month, and board.
- 5) During sheep-shearing, when much labour is required, 0.03 to 0.05 peso per sheep sheared is paid, according to whether shearing is done by machine or hand.

**CROPS.** — About 2 500 000 acres are under cultivation, and about 1 650 000 acres of this area are under wheat and maize. The country produces sufficient cereals and oil seeds for its own consumption, and exports wheat, maize (grain and flour), flax, lucerne, etc., to the annual value of from 4 to 5 million gold pesos.

Agriculture is carried out on an extensive scale, with little preparatory work, no manure and no irrigation. It was only in 1915, thanks to the initiative of the State and of the Central Railway Company, that selected wheat seed was first distributed to the farmers, great facilities for payment being offered. This has raised the production by from 6 cwt. per acre (general average for the whole country) to 9 to 10 cwt. per acre. In considering these figures it must not be forgotten that, in Uruguay, sowing is very thin, about 53 lbs. of seed being used per acre.

Table II gives data for the year 1913-1914.

TABLE II. — *Principal crops of Uruguay in the Year 1913-1914.*

	Area sown	Quantity of seed used	Crop	Value of the crop per acre
	acres	tons	tons	pesos
Wheat . . . . .	901 453	23 420	157 696	9,88
Maize . . . . .	692 484	3 882	178 563	8,24
Flax . . . . .	128 232	2 572	24 065	8,91
Oats . . . . .	97 443	2 490	26 428	—
Barley . . . . .	14 048	325	3 528	—
<i>Phalaris canariensis</i> . . . . .	5 957	952	1 263	—
Rye . . . . .	452	13	116	—

The cultivation of forage crops has made rapid progress. The 1908 census showed them to be grown over 312 166 acres; in 1916 this area had doubled. The forage crops most cultivated are oats and lucerne. Oats are the most common, and are also used as pasture. They are sown in the first months of the year and grazed between mid-April and mid-September, if a grain crop is desired as well, or, when this is not the case, up to mid-October. During the 5 months, grazing oats produce about 127 cwt. of fodder per acre. A field of oats lasts from 2 to 2 1/2 years.



The yield of lucerne is from 2 to 6 tons per acre. It is cut from 3 to 5 times a year, and the field lasts between 5 and 20 years.

On the basis of quality, *natural* meadows and pasture grounds ("campos") are divided into "very good" or "choice", "good", "regular". In the meadows of the first group an animal of from 8 to 12 cwt. may easily be fattened on 1 ½ or 2 ½ acres, in those of the 2nd. group on 2 ½ to 3 acres, and, in the 3rd, on 3 to 4 acres. In the 3rd group fattening is neither very easy nor very economical.

The food value of the natural meadows and pasture land is such that an animal of 8 cwt. may be kept on a daily ration of from 44 to 50 lbs. and fattened on a ration of 99 to 110 lbs. The tender grass ("pastos tiernos") of Uruguay contains on an average: 1.7 % of albuminoid, 0.6 % of fat, with the starch value 11.1. This starch value equals that of lucerne and of oats (hay).

Taking into consideration their high food value, good yield and the limited water content of their products, the meadows of Uruguay are extremely well suited to the production of hay, indeed the yield is very high, 65 to 70 % the weight of the grass. The spring cut gives 12 to 32 cwt. per acre, the autumn cut a little less. Table III gives data concerning the best fodder plants of Uruguay.

TABLE III. — *Yield and composition of the principal fodder crops of Uruguay.*

	Common name	Yield per acre		Composition (per cent)			
		Grass (cwts.)	Hay (cwts.)	Albu- minoid	Fat	Fibre	Nitro- gen-free extract
<i>Avena elatior</i> . . . . .	timothy	163	47	8.50	2.52	21.77	29.51
<i>Phleum pratense</i> . . . . .	timothy	99	30	1.82	0.56	12.10	13.20
<i>Dactylis glomerata</i> . . . . .	dactilo aglomerado	160	47	3.19	0.97	8.17	11.47
<i>Festuca pratensis</i> . . . . .	festuca	150	44	3.92	0.91	16.24	7.44
<i>Agrostis vulgaris</i> . . . . .	pa.sto ilusión	134	39	—	—	—	—
<i>Trifolium pratense</i> . . . . .	trébol morado	80	20	3.62	0.71	4.00	8.83
<i>T. repens</i> . . . . .	" blanco	75	19	2.63	1.20	1.92	4.74
<i>T. hybridum</i> . . . . .	" híbrido	94	29	3.37	0.75	4.43	10.55
<i>Lolium italicum</i> . . . . .	ray grass	168	63	7.31	2.00	18.95	17.15
<i>L. perenne</i> . . . . .	ray grass	213	80	7.02	2.02	26.38	27.10
<i>Poa pratensis</i> . . . . .	poa	106	32	2.69	0.46	14.10	9.00
<i>Echium violaceum</i> . . . . .	flor morada	175	—	—	—	—	—
<i>Bromus unioloides</i> . . . . .	cebadilla	246	—	—	—	—	—

Sugar beet, grown for a sugar-factory, is cultivated on 8 648 acres.

In 1914, Tobacco was cultivated over an area of 2 503 acres and yielded 272 cwt. of dry leaves.

According to the 1908 census, *fruit growing* occupies more than 74 133 acres, and the production exceeds 196 cwt. of fruit. Plums are grown to

a very large extent (over 2 million trees in bearing). They do well in all districts, and the trees bear when 3 years old. Oranges do well in the southern part of the country, the best are those of Salto, Cerro Largo, etc. The olive tree has only been introduced of late years. Pears, apples, apricots, cherries and the majority of the fruit trees of the temperate zone do well and bear abundantly throughout Uruguay.

*Vine-growing* has greatly developed. In 1912 there were 2 067 vineyards covering an area of 14 826 acres, with more than 20 million plants bearing fruit. In 1911, 3483 tons of grapes yielding 2 482 600 gallons of wine were gathered.

**ANIMAL PRODUCTION.** — Laws have been passed to protect cattle from the importation of contagious diseases, and to prevent the spread of infection within the country. The chief diseases calling for sanitary control (isolation of stables, obligatory vaccination, etc.) are: — symptomatic anthrax and tuberculosis of all animals; "tristeza" or cattle piroplasmiasis, sheep scab, aphtous fever of cattle, sheep and pigs.

In a normal year the average mortality from all causes is 4 % for cattle, 2 to 3 % for sheep, taking 4 years as the average length of life.

The cattle graze over a large area and the best natural pastures are used. These are composed essentially of Gramineae, Leguminosae and Chenopodiaceae, and divided into "pastos duros" (rough grass), suitable for nourishment only, and "pastos tiernos" (tender grass), suitable for fattening.

On many farms where sheep and cattle are bred, lucerne and oat fields are used throughout the year for feeding cattle kept in stables either permanently or only during part of the year. Other farms use the oat-fields for the winter feeding of young cattle. In this case they are kept in the fields from April to the end of October. By this method it is easily possible to fatten 1 animal per acre, and 2.5 to 3 sets of animals are thus fattened per annum.

Breeding animals kept in the stables throughout the year are fed oats, lucerne (fresh and as hay), maize, linseed cake, etc. As a rule, a calf between 6 and 8 months receives, besides fresh lucerne and lucerne hay each evening, a complementary ration of from 6  $\frac{1}{2}$  to 8  $\frac{3}{4}$  lbs., which increases as the calf grows older, till, at 2 years, it receives 17  $\frac{1}{2}$  to 22 lbs. fed in 3 different lots. The following mixture is frequently used: 8 parts by weight of oats + 5 parts of maize + 2 of bran + 2 of linseed.

The following breeds are reared in Uruguay:

I. — **HORSES:** English pure-breds, Morgan, Criolla, Boulonnais, Clydesdale, Trakehnen, Hackney. Their total number is 600 000

II. — **CATTLE:** 1) — *Beef-Cattle:* Herefords, which represent  $\frac{2}{3}$  of all the cattle, Short-horns, Polled-Angus. The "criollo" breed, descended from the Spanish race, has been improved by crossing with these 3 races, and the majority of the cattle are descendants of these crossings with fixed characteristics. The 1908 census showed a total of 8 200 000 cattle, of which  $\frac{4}{8}$  were beef cattle.

2) *Dairy Cattle:* As yet there is no dairy breed well adapted to the surroundings and showing decided advantages over the other breeds. The following pure breeds have been kept



for breeding purposes; Dutch, Norman, Flemish, Schwitz, Jersey. Many farms specialise in the breeding of improved cattle with a view to the production of milk, which is their chief industry (1). According to the 1908 census the total number of dairy cattle of that date was 565 854, divided as follows:— 10 775 pure breds, 269 103 progeny of various crosses, 205 385 "criollas", 60 591 non-specified. The census now being taken shows these numbers to have increased greatly.

III: SHEEP: Their total number is 27 million. The breeds which are most frequently found and which have proved to be the best are:—Merino, Rambouillet, Lincoln, Romney Marsh. The Hampshire and Shropshire breeds have been introduced recently.

IV: PIGS: Berkshire, Large Black, Poland China, Middle White Yorkshire. Their total number is 200 000.

Cattle attain their full strength at  $4\frac{1}{2}$  — 5 years, in the case of improved stock, and at  $7 - 7\frac{1}{2}$  years in the case of "criollas". Table IV shows the average weight of animals from 3 to 5 years old.

TABLE IV. — *Average weight of cattle from 3 to 5 years of age.*

	at 2 years	at 4 years	at 5 years
	lbs.	lbs.	lbs.
Hereford oxen . . . . .	880	1144-1210	1232-1259
Shorthorn oxen . . . . .	1012-1056	1166-1232	1232-1276
Cows . . . . .	814	880	924-964
Bulls . . . . .	1034-1100	1100-1166	1166-1320

The average annual number of births among cows kept on good natural pasture land is 80 %, on pasture of inferior quality, from 65 to 70 %.

The average prices of good breeding cattle are:— oxen, 35 to 40 pesos, bulls 30 to 35 pesos, cows 28 to 32 pesos, calves 8 to 10 pesos.

The average prices of animals put to grass for fattening are:— oxen 53.91 pesos, bulls 51.20 pesos, cows 38.68 pesos, calves 16.77 pesos. These prices decrease during the months when grazing is at its maximum and increase during those when it is at its minimum. Grazing is most general in March, and diminishes continuously till July and August, when it increases again till December.

518 — **The Purification of Rain Water for Human Consumption.** — See No. 582 of this *Bulletin*.

519 — **Courses of Practical Agricultural Engineering in Italy and France.** — I. TOSCANO, DARIO, Course of practical agricultural engineering in Sicily, in *Il Coltivatore*, Year 63, No. 12, pp. 394-395. Casale Monferrato, April 30, 1917. — II. School for drivers of agricultural machines, in *Le Progrès Agricole et Viticole*, Year 34, Vol. 67, No. 8, p. 189. Montpellier, February 25, 1917.

I. *Courses of practical agricultural engineering in Sicily.* — Thanks to the initiative of an inter-provincial meeting of the Agricultural Com-

RURAL  
HYGIENE

AGRICULTURAL  
EDUCATION

(1) See also, in B. 1916, pp. 677-685, the Report by Dr ARTURO ABELLO: *Dairying in Uruguay*.



missions held at Catania in February, 1917, under the patronage of the Department of Agriculture, courses for instruction in agricultural engineering were instituted, and are about to be inaugurated. They are supported by funds supplied by the provincial Government departments and by the Chambers of Commerce of the Sicilian provinces, as well as by a subsidy from the Department of Agriculture.

There will be two courses in the provinces of Catania and Caltanissetta, one at the Royal Oenological School of Catania, the other at the Agricultural School of Caltagirone. Another course will be held at Palermo, Girgenti and Trapani, a 4th. at Syracuse at the Royal Station for Agricultural Machinery annexed to the "Cantina sperimentale" (Oenological Experiment Station) of Noto, and a 5th. at Messina.

Each course will last about a month, and the pupils will be chosen from amongst farmers and mechanics. The instruction will be, above all, practical and will include 6 to 8 hours a day of practical work on the use and general management of agricultural machines and motors, methods of taking them down and assembling them, repairs. There are only 2 hours of oral instruction on agricultural machines, motors and materials used in the construction of machines, fuels and lubricants, etc. At the end of the course a certificate will be given to those who have shown the required standard of efficiency.

So many applications have been received that it will probably be necessary to repeat the course.

II. — *School for drivers of agricultural machines in France.* — A special residential school for drivers of agricultural machines, called the "Gomel Pujos Institute", has just been founded at Noisy-le-Grand (Seine-et-Oise). The aim of the Institute is to train specialists in the use and repair of agricultural machines, particularly motors. It will also be used for experimental and demonstration purposes and will answer enquiries concerning mechanical cultivation, etc.

520 — *School for Farmers at the Royal Colonial Garden of Palermo.* — BORZI, A., in *Bollettino di Studi ed Informazioni del R. Giardino Coloniale di Palermo*, Vol. III, Pt. 1-2, pp. 3-7. Palermo, 1916.

The aim of this new school for farmers started at the Royal Colonial Garden of Palermo, is to train the Sicilian peasant in agricultural methods so that he may be capable of acting on his own initiative. Instruction is almost entirely practical, and the syllabus restricted, so that it may be well developed and thoroughly assimilated.

The lectures are public and attended by those farmers who are interested in the subjects treated. The Department of Agriculture makes grants to peasants living at a distance to enable them to attend the school.

There are 6 hours a week of theoretical instruction, of which 3 are devoted to colonial agriculture, 2 to various subjects and 1 to the general knowledge of natural bodies and phenomena. The rest of the time is spent in the garden, where the theories taught in the lectures are applied practically under the supervision of the head and technical staff of the Garden.

The general lines of instruction are given below: —

## 1) VARIOUS SUBJECTS.

The enemies of health: elements of human and domestic hygiene, preventive and first-aid measures.

Outlines of the most important discoveries.

Outlines of geography bearing on the principal European emigration tracks.

Italy and her colonies; their agricultural products.

The State and civil institutions. The citizen and his principal rights and duties. Emigration and its laws.

## 2) GENERAL KNOWLEDGE OF NATURAL BODIES AND PHENOMENA.

Air, water, the earth, light and heat.

Plants and animals. The nourishment and life of plants, their propagation.

## 3) COLONIAL AGRICULTURE.

## CROPS AND CULTIVATION.

521 - A Study of Climatic Conditions in Maryland (United States) as Related to the Growth of the Soy-Bean. — McLEAN, FORMAN, T., in *Physiological Researches*, Vol. 2, No. 4, pp. 129-208, 14 fig. Baltimore, February 1917.

AGRICULTURAL  
METEOROLOGY

A series of experimental researches undertaken for the purpose of determining the quantitative relations between climatic conditions and the growth of plants, the plant (in this case soy bean) being regarded as a kind of integrating and recording instrument, the reading of which is zero at the beginning of each observation period.

In order to have the plants of all tests nearly alike at the beginning of each period, the observations were confined to the first 4 weeks after germination. A new observation period began approximately every 2 weeks, so that the different periods overlapped. The seeds were planted in plunged pots, all containing the same soil, and the pots were furnished with auto-irrigators, to maintain the soil moisture constant. The influence of rainfall was thus removed from the main consideration; temperature, evaporation and sunshine being, therefore, the climatic conditions with which the study chiefly deals.

The 2 stations chosen were Oakland (in the mountains of west Maryland) and Easton (on the eastern shore of Chesapeake Bay). The difference between the 2 types of climate were, as will be seen later, clearly shown by the growth of the plants.

The species employed were *Glycine hispida* Maximov. — *Vicia faba* L., *Zea Mays* L., and *Triticum sativum* L. Only the results obtained with *Glycine hispida* (soy-bean) are dealt with in the paper analysed.

It appears that temperature was clearly the limiting condition for growth, the effect of moisture, though constant and certain, was much less noticeable.

The following is a summary of the most important results of the experiments.

1) During the whole growing period (i. e. throughout the year except when there were frosts) the general conditions were more favourable to the growth of the soy-bean at Easton than at Oakland. This is shown by



all the data concerning — leaf surface — length of stem — dry weight of tops. Thus for the first 2 weeks of growth from seed, the average daily growth increment in terms of leaf-product (the mean of the products obtained by multiplying the length of each leaf by the breadth) was 1.2 for the Easton season and 0.9 for the Oakland season. On the other hand, the growing season was 171 days at Easton and only 103 days at Oakland.

By multiplying each of these two values by the average daily increase in leaf product, the numbers representing the growth possibility of soya at the 2 Stations in question are obtained, namely:  $171 \times 1.2 = 205.2$  at Easton:  $103 \times 0.9 = 92.7$  at Oakland. The proportion between these two numbers is as 2.21: 1.00, which shows that the coastal climate is more favourable to plant growth than the mountain climate.

2) The relation between: stem height, leaf surface and dry weight on the one hand, and the climatic factors on the other, varied greatly according to the culture period. The rates of growth in terms of leaf surface and in terms of dry weight varied in a similar manner with the same kind of variations in external conditions, while the growth rates measured in terms of stem elongation varied in another way: thus, it was generally more rapid during the 1st. than during the 2nd. fortnight, while the increase in leaf area and in dry weight was more rapid during the 2nd. fortnight.

3) Temperature is certainly the chief factor, and the temperature curve is similar to the growth curve. The growth conditions of the soybean are very different at the two stations in question. The growing season was terminated by a killing frost earlier at Oakland than at Easton. Nevertheless, the 2 week's period before autumn frost at Oakland exhibited a higher temperature value and higher growth rates than at Easton. In the mild climate of the shores of Chesapeake Bay with its small daily range of temperature, the frostless season is apt to be prolonged until the growth of many plants is much reduced, or entirely checked, by low temperature. In the mountain climate of Maryland, however, with its large daily range of temperature and high nocturnal radiation, the frosts occur earlier in the season, while the day temperatures and the growth rates of many plants are still high. This occasions the almost sudden interruption in curve which is observed at Oakland when autumn sets in.

4) The mean rate of leaf enlargement (as measured by the leaf product) and also the mean rate of increase in dry weight, followed seasonal marches that showed a secondary influence of the moisture conditions of the surroundings, as well as the primary one exerted by temperature. The influence of the general moisture conditions of the surroundings (measured in terms of the ratio of rainfall to evaporation) was most clearly shown when the daily mean temperature was high ( $18.8^{\circ} - 24.4^{\circ} \text{C.}$ ), particularly during the 2nd. fortnight; during the 1st. fortnight, on the contrary, the soybean plants were more susceptible to the influence of the temperature.



522 - The Reaction Between Dilute Acids and the Phosphorus Compounds of the Soil. — RUSSELL, E. J., and PRESCOTT, J. A., in *The Journal of Agricultural Science*, Vol. VIII, Part. 1. pp. 65-110 + 9 fig. Cambridge, 1916.

Few reactions are more important to the soil chemist than that involved in the action of dilute acids on the phosphorus compounds of the soil, but owing to its complex nature, little has been definitely ascertained about it.

The writers examine the literature dealing with this subject and state that it is inaccurate to regard the soil as a collection of insoluble inert mineral fragments admixed with small quantities of more soluble substances, some of which arose by weathering or other decomposition processes. They found that the most convenient method of studying the question is to shake a definite weight of the soil (50 or 100 gr.) with a uniform volume (1 litre) of acid at a constant temperature (23° C.) for a definite time, and then to estimate the amount of phosphorus compounds in the solution.

The results enable us to explain what happens when a soil is shaken with a dilute acid in the ordinary process of soil analysis.

The acid dissolves out such phosphorus compounds as it can, and different acids have much the same effect at equivalent concentrations. Nitric, hydrochloric and citric acids give the same results; sulphuric acid gives a somewhat higher result. A reverse action, however, sets in. Some of the phosphoric acid is withdrawn from the solution, in spite of the presence of excess of acid. The process is an ordinary adsorption pro-

cess and obeys the usual law expressed by the equation  $y = Kc^{\frac{1}{p}}$  (1): its extent varies with the different acids; it is much more marked in the presence of nitric than of citric acid. The amount of phosphoric acid actually determined by the analyst is, therefore, not the true amount dissolved, but the difference between these two wholly distinct actions. It is now obvious why the amounts of "available phosphoric acid" determined by extraction with dilute acids show such great variations in different methods of analysis, and so little correlation with the actual quantities obtainable by the crop. In no case do they stand for anything actual, but only for a difference between a direct action and an adsorption which varies with the nature of the acid and the conditions of the experiment.

So long as they are confined to the same type of soil, however, any of the acids investigated would have given useful results, but difficulties would arise directly an attempt was made to compare dissimilar soils.

The writers describe a diffusion method in which the reverse action, is eliminated, and which, therefore, gives a true measure of the direct action, but until further experiments have been made, it is not possible to determine its value for soil analysis.

(1)  $K$  and  $p$  are constants under the given conditions;  $c$  equals the concentration of the phosphoric acid in solution and  $y$  the amount of substance adsorbed. The constant  $K$  represents the tenacity with which the soil keeps the phosphoric acid and  $p$  is the manner in which the adsorptive capacity of the soil is satisfied under the conditions of the experiment.

(Ed.).

523 - **The Oxidising Power of Some Soils in Deli, Sumatra.** — HONING, J. A., in *Bulletin van het Deli Proefstation*, No. 8, Medan, January 1917.

GERRETSEN calls the number of mg. of iodine liberated by 100 grm. of dry soil from a dilute solution of potassium iodide acidified with sulphuric acid, the hydrogen-iodide value. From well mixed soil samples 2 grm. are rubbed in a mortar and washed in an Erlenmeyer flask; 5 cc. of a 1 % solution of potassium iodide are added, also 6 drops of sulphuric acid (1 : 1). After 5 minutes the liquid is centrifuged, filtered and titrated with N/100  $\text{Na}_2\text{S}_2\text{O}_3$ . After determination of the moisture the value for 100 grms. dry soil can be calculated.

By this method GERRETSEN (1) could distinguish between soils in good condition and those that are poor, and insufficiently oxidised, as the soils with a high an hydrogen-iodide value gave a rich crop of sugar or rice, and those with a low value, a small crop.

When this method of testing irrigated soils in Java was tried on dry soils in Deli, it proved to be impracticable; very often the hydrogen-iodide value was very high in samples taken at a depth of one or two feet below the surface, and very low or even nil on the surface. Moreover these soils with a very low or with no hydrogen-iodide value are not bad. for practical purposes. They are black "dust-soils" with a high percentage of humus; (VAN BYLERT (2) found 7.6 %), and the organic matter immediately absorbs the iodine liberated in the solution.

The very high hydrogen-iodide value of soil samples taken 30-90 cm. beneath the surface is caused, not by a higher degree of oxidation of the soil at that distance from the free air, but by the large quantity of oxidised material, i. e. ferric iron. This ferric iron is not equally divided over the whole depth but partly accumulated in thin layers, strips or patches, at some distance from the surface.

From these causes, the presence of large quantities of humus and the irregular and changeable distribution of the ferric iron, which is indeed the determining factor, the method breaks down when applied to non-irrigated soils in Deli.

524 - **The Action of some Olygodynamic Elements on Nitrogen Fixing Bacteria.** — MONTANARI, C., in *Le Stazioni Sperimentali Agrarie Italiane*, Vol. 50, Pt. 2, pp. 69-72. Modena, 1917.

Besides the action of manganese (previously studied in *Le Stazioni Sperimentali Agrarie Italiane*, Vol. 47, p. 441) experiments have been carried out on the action of the following elements: copper, barium, zinc, lead, arsenic. Very white silicious sand from Tripalla (Tuscany) was used as basis. It was washed, first with concentrated hydrochloric acid, then with distilled water. The sand was mixed with 2 % of pure calcium

(1) F. C. GERRETSEN. Het oxydeerend vermogen van den bodem in verband met het uitzuren. — *Mededeelingen van het Proefstation voor de Java-Suikerindustrie*, deel V, bb. 317-331, 1915.

(2) A. VAN BYLERT. Onderzoek van eenige grond soorten in Deli. — *Mededeelingen uit's Lands Plantentuin*, XXI, 1897.

carbonate, precipitated and moistened with water to which had been added the necessary quantity of nutritive substances (ammonium sulphate and phosphate, potassium sulphate and magnesium sulphate). By this method the best conditions for nitrification were obtained.

The olygodynamic elements used were added either at the beginning of the experiment, at the moment of inoculation, or else after nitrification had set in and developed strongly. To 100 gr. of sand 0.01 gr. of the element was added, in the series 1-8 (see the appended table) and to the series 9 to 16, 0.05, or even 0.10 gr. of the element was added. The other conditions of the two series were identical. The experiments, carried out at the Royal Technical Institute of Mantua, lasted about 2 years.

*Action of some olygodynamic elements on nitrification.*

Number	Compounds added per 100 gr. of artificial soil		Average quantities of nitrates found after addition of the elements	
			At moment of inoculation mg.	After strong development of nitrogen bacteria mg.
1	None . . . . .		1.90	12.8
9	None . . . . .		1.80	12.8
2	Manganese peroxide 10 mg. . . . .		1.65	12.8
10	<i>idem</i> 50* . . . . .		1.30	12.8
3	Manganese sulphate 10 . . . . .		2.20	12.8
11	<i>idem</i> 50* . . . . .		2.20	12.8
4	Copper sulphate 10 . . . . .		0.10	12.8
12	<i>idem</i> 50* . . . . .		none	8.3
5	Barium carbonate 10 . . . . .		1.60	12.8
13	<i>idem</i> 50 . . . . .		1.10	12.8
6	Zinc sulphate 10 . . . . .		1.40	12.8
14	<i>idem</i> 50 . . . . .		traces	12.8
7	Lead carbonate 10 . . . . .		1.40	12.8
15	<i>idem</i> 50 . . . . .		0.20	12.8
8	Arsenious anhydride 10 . . . . .		1.05	2.0
16	<i>idem</i> 50 . . . . .		0.40	0.6

\* 100 mg in some experiments.

The figures given in the table represent an average of at least 6 experiments. The quantities of nitrates produced are calculated in mg. of potassium nitrate per 100 gr. of dry artificial soil. These figures show that the action of some of the elements varied fairly considerably according to whether they were added at the beginning of the experiment or when nitrification was already in progress. In the first case, the addition of



copper, even in small quantities, of barium, zinc, lead and arsenic, the latter in larger quantities only, had a marked inhibiting effect. In the second case, however, owing to its vigorous development, the ferment was unaffected except by the largest quantities of arsenic and copper.

It should be noted that in none of the experiments did the various elements, even when added in the smallest quantities, have a stimulative or favourable effect on the development of the ferment. Manganese sulphate was the only exception to this rule. This accounts for the prejudicial action of these elements on nitrogen bacteria.

525 — **The Use of Dog's Tooth Grass (*Cynodon Dactylon*) for Binding Shifting Sands in Sicily.** — Borzì, A., in *Bollettino di Studi ed Informazioni del R. Giardino Coloniale di Palermo*, Vol. III, Pt. 3-4, pp. 101-116 + 2 plates. Palermo, 1916.

Dog's tooth grass is a perennial found in all countries. It grows very easily and spreads rapidly, and is, therefore, well suited for binding shifting sands, and should be used for this purpose much more than it is at present.

The author describes its use as a binding plant in the sandy plain adjoining the sea between Cape Rosocolmo and Milazzo (province of Messina). Here, large stretches of ground, reclaimed from the sea each year and swept by strong winds, have been transformed into vineyards, orange groves and kitchen gardens by binding them together with *Saccharum spontaneum* (1) and *Cynodon Dactylon*, and, in some cases, with the latter grass alone.

On account of its shortness dog's tooth grass is not so good a protection against wind as *S. spontaneum*, nevertheless, when wild it forms compact clumps which are useful in the construction of dikes, banks and similar works and are more resistant and durable than masonry. A description is given of a case in the Staitini district, near San Filippo Archi, where this plant was used in the construction of a dam for irrigation water, measuring 98 ft. in length, 15 ft. in height, and about 7 ft. in width at the base.

The procedure for building constructions of this kind is as follows: — a large quantity of stems and rhizomes of *Cynodon Dactylon* are pulled up with a hoe. These are placed in a single layer about 8 to 12 inches thick over the site of the proposed dike. The whole is then covered with earth 8 to 12 inches deep, and pressed down with the back of the hoe or spade and the feet. The work is usually started in autumn so that the rains may cause a rapid growth of the grass. Towards the end of winter the process is repeated, a new layer of grass and one of earth being added. This second operation helps to raise the construction, but is only indispensable when the growth of the first layer of *Cynodon* is slow and incomplete. Such cases are, however, rare.

Dog's tooth grass should not be pulled up from soils it has fixed when wind and sea-water resisting trees and bushes (such as: *Pinus pinaster*,

(1) See B. 1916, No. 491.

(Ed).

*Juniperus macrocarpa*, *Tamarix gallica* and *T. africana*, *Casuarina equisetifolia* and *C. tenuifolia*, *Myoporum insulare*, *Spartium junceum*) are planted. In such cases holes should be made of sufficient depth to take fairly strong trees of the varieties chosen.

Attention is drawn to the value of dog's tooth grass as a fodder-crop.

526 - **The Rapid Increase in the Output of American Potash.** — *Commerce Reports*, No. 45, p. 728. Washington, D. C., February 23, 1917.

MANURES  
AND MANURING

Greatly increased production of potash in the United States of America during 1916 is reported by the United States Geological Survey, which also expressed the belief that the output for 1917 will be much greater. The total production of potash salts and potash products in the United States in 1916 represented about 10 000 short tons of pure potash, with a net value at point of shipment of at least \$ 3 500 000 figured at the prevailing selling prices. This is ten times the value of the production reported for 1915, but the figures submitted by many of the producers represent only a start made toward the end of 1916.

The production of potash reported to date for 1916 may be summarised as follows :

Mineral sources : Natural salts or brines, 3 850 short tons ; alunite and silicate rocks, including furnace dust recoveries, 1 900 ; total mineral, 5 750.

Organic sources : Kelp, 1 110 ; pearlash (mostly from hardwood ash), only 23 producers having reported to date out of a list of 70 establishments said to be producing, 220 ; miscellaneous industrial wastes, 1 750 ; total organic, 3 080.

Total output, 8 830 short tons.

The largest output has come from the Nebraska alkali lakes, but the natural saline deposits elsewhere are now just beginning to make important contributions. The figures for potash derived from alunite, of which there is only one important producer, are combined with those for available potash in cement-kiln, fluedust, greensand, and feldspar recoveries, in order not to disclose figures given in confidence. These do not include a considerable quantity of feldspar said to have been mined and prepared for possible use for the sake of the potash it contains. The production of potash from organic sources is about half that from mineral sources. The recovery of potash from pearlash is an old established industry.

527 - **Bromine Content of German Potash Salts.** — WINKLER, L. W., in *Zeitschrift für angewandte Chemie*, Year 30, Pt. 27, pp. 95-96. Leipzig, April 3, 1917.

As a continuation of his work on the iodine content of Stassfurt salts (1) the author gives the results of his experiments on the bromine content of the various German potash salts. The results are summarised in the appended table. The method by which the bromine was estimated is described.

(1) See B. 1916, No. 1167.

(Ed.).

*Bromine Content of various German Potash Salts.*

Salt	Average percentage of bromine
<i>Sylvine</i>	
white, from Burbach . . . . .	0.299
colourless, from Gross-Rhüden . . . . .	0.300
colourless, from Aschersleben . . . . .	0.267
reddish-yellow, from Vienenburg . . . . .	0.117
red " " . . . . .	0.118
white, from Hänigsen . . . . .	0.236
<i>Carnallite</i>	
red, from Sondershausen . . . . .	0.177
colourless, from Burbach . . . . .	0.302
reddish-yellow, from Burbach . . . . .	0.155
pinkish-yellow, from Mecklenburg . . . . .	0.143
commercial salt, from Werragebiet . . . . .	0.187
grey, from Stassfurt . . . . .	0.303
red " " . . . . .	0.356
reddish, from Gross-Rhüden . . . . .	0.266
red, from Aschersleben . . . . .	0.334
grey, " " . . . . .	0.329
colourless, from Vienenburg . . . . .	0.268
yellowish " " . . . . .	0.238
reddish " " . . . . .	0.284
<i>Sylvinite</i>	
Grey, from Känigsen . . . . .	0.085
red, from Alsace . . . . .	0.331
reddish " " . . . . .	0.301
<i>Hartsalz</i>	
from Burbach . . . . .	0.027
from Werragebiet . . . . .	0.052
<i>Langbeinite</i> from the Leine Valley . . . . .	0.016
<i>Bischofite</i> from Vienenburg . . . . .	0.467
<i>Tachydrile</i> from Vienenburg . . . . .	0.438

From these data it may be seen that German potash salts contain a fairly high percentage of bromine.

528 - **The Addition of Tar to Calcium Cyanamide to Facilitate Spreading: Experiments made in Germany.** — SCHMOEGER and LUCKS, in *Mitteilungen der deutschen Landwirtschafts-Gesellschaft*, No. 10, pp. 156-157, Berlin, March 10, 1917.

Under the auspices of the Prussian Department of Agriculture experiments are carried out at the Agricultural Station at Danzig (Prussia) in order to find, if possible, a method to facilitate the spreading of calcium cyanamide. It was found that good results were obtained by mixing the manure with 15 % coal-tar.

The cyanamide is first mixed with the tar and then passed through a mincing machine. The material thus obtained is rather similar to superphosphate. It may be easily spread without powdering, a characteristic



which it does not lose even when kept for a long time. The addition of tar causes no loss of nitrogen.

In order to determine whether the addition of tar is harmful to plants fertilised with cyanamide, pot manuring experiments were carried out with oats during the summer of 1915. The plants grew equally well in pots treated with cyanamide and tar as in those treated with pure cyanamide or with ammonium sulphate, and much better than in pots without nitrogenous manure. As the experiment was commenced very late the oats only reached the flowering stage and the yield could not be controlled.

In April, 1916, a second experiment was begun. This was carried out with 10 pots divided into 5 equal groups treated respectively with the following manures: —

Group 1	No manure
Group 2	Pure calcium cyanamide
Group 3	Cyanamide + 10 % tar
Group 4	Cyanamide + 25 % tar
Group 5	Ammonium sulphate

In each pot were sown 20 oat seeds, in 5 immediately after manuring, in the other 5 a fortnight later. The pots were kept in the garden throughout the whole experiment.

Sprouting was normal in all the pots, but shortly after, the plants which had not been manured showed less vigour. During the summer it was observed that, in all the plants (also in those which had not been manured) the tip of the leaf was white. Later it ascertained that this peculiarity was due neither to a parasite (*Thrips*) nor to the cyanamide. The plants matured well nevertheless and gave the following average yields: —

	Grain	Straw
Group 1 . . . . .	7.1	13.0
Group 2 . . . . .	12.5	24.2
Group 3 . . . . .	12.4	23.2
Group 4 . . . . .	12.5	21.6
Group 5 . . . . .	12.2	24.3

Nitrogenous manure increased the yield by about 70 % without there being any visible difference between the various kinds. It may, therefore, be concluded that cyanamide had no harmful effect on the plants.

In 1915-16, the experiment was repeated with wheat in the open. Six plots of 614 square yards each were used. Three of these were treated with 35 lbs. of cyanamide and tar, the other 3 were not manured. Pure cyanamide was not tested. The manure was harrowed in and the seed sown immediately after. The plots, especially those which had been manured, all looked exceedingly well throughout the experiment.

Two hundredweight of tarred cyanamide (16.7 % nitrogen) increased the grain yield by 1.04 cwt. and the straw yield by 4.07 cwt. This

relatively small increase is not surprising as the sowing conditions were particularly bad and the soil already sufficiently rich in nitrogen, and there is no reason to attribute it to the mixture of cyanamide and tar.

529 - **The Use of Lead for Stimulating Growth in Plants; Manuring Experiments in Germany.** — STUTZER, A., in *Journal für Landwirtschaft*, Vol. 64, Pt. 1 and 2, pp. 1-8. Berlin, 1916.

Experiments carried out in 1914 and 1915 on the action of aqueous solutions of lead nitrate showed that plants grew vigorously when treated with small quantities of lead. The maximum growth was obtained with 0.5 gr. of nitrate per litre of nutritive solution. Not only did larger quantities affect the development of the roots, but they also retarded that of the leaves. The same results were obtained in this respect with all the experimental plants: — rye, wheat, oats, barley, maize and peas. The difficulty of spreading the lead nitrate was overcome by making it into a fine powder and mixing it well with the potash salt or sodium nitrate used as manure.

Manuring experiments with beets resulted in a certain increase in yield of both roots and sugar which could be attributed to the lead nitrate. Potatoes, on the other hand, proved very sensitive to the action of lead which caused a decrease yield of tubers and starch.

The following table gives the results of experiments on wheat in sandy loam: —

*Effect of lead nitrate on wheat yield.*

	Yield per acre	
	Grain cwt.	Straw cwt.
a) Basic manure without nitrogen in the form of sodium nitrate . . .	18	29
b) Basic manure + 44 lbs. nitrogen in the form of sodium nitrate . .	21	37
c) Manure b) + 9 lbs. lead nitrate . . . . .	18	32
d) Basic manure + 66 lbs. nitrogen in the form of sodium nitrate . .	22	38
e) Manure d) + 9 lbs. lead nitrate . . . . .	25	44

The results obtained lead to the following conclusions:

1) The addition of 44 lbs. of nitric nitrogen to basic manure increased the grain yield by 880 lbs.; 56 % of this nitrogen was assimilated. The addition of 9 lbs. of lead nitrate only increased the grain yield by 187 lbs. as compared with basic manure, and only 21.5 % of the nitrogen was assimilated.

2) The addition of 66 lbs. of nitric nitrogen to the basic manure increased the grain yield by 1320 lbs., and 82.3 % of the nitrogen was assimilated. In this case the addition of 9 lbs. of lead nitrate had a favourable effect on the grain yield, which it increased by 2 123 lbs. as compared with the basic manure.

It was not possible to prove the extent to which atmospheric conditions influenced this result. It is, however, thought probable that the action of the lead nitrate depends on the state of nutrition of the plant, and that, in subsequent experiments with stimulants, particular attention should be given to determining the limit at which lead nitrate reaches

its greatest efficiency as compared with the state of nutrition of the plant. In the soil, lead nitrate is converted into sulphate and carbonate, which dissolve with difficulty. They are, however, very finely divided (in the hydrated state) and well distributed, so that the efficiency of the lead is preserved.

There is nothing against the practical use of lead nitrate, and, so long as the manufacturer can guarantee a uniform distribution of the lead, the mixing of lead nitrate with potash salts and sodium nitrate on a commercial basis is recommended.

530 - **Useful Plants found in the Columbian Republic, Central America.** — BRAVO, JORGE E., in the *Revista Nacional de Agricultura*, Year IX, Series XII, Nos. 148-149, pp. 943-951, 992-1006. Bogotá, October-November 1916.

CEREALS: — All do well in Columbia, especially maize, which is native.

TUBER AND ROOT CROPS. — Columbia is very rich in these crops; the principal native varieties are: — “papa” (*Solanum tuberosum*); “arracha” (*Arracacia xanthorrhiza*, = *A. esculenta*); “batata” (*Ipomoea Batatas*); “yuca” (*Manihot utilissima*); “sagù” (various species of *Maranta*); “tabena” (*Dioscorea sativa* = *D. Cliffordiana*); “mafafa” (*Colocasia antiquorum* = *C. esculenta*); “achira” (*Canna edulis*); “ibias” (*Oxalis tuberosa*); “chuguas” (*Ullucus tuberosus* = *U. Kunthii*).

FIBRE CROPS: — Cotton growing is progressing rapidly in Columbia. There is a native arborescent variety which is perennial and very productive. It yields a cotton which, though a little long, is of excellent quality. The following crops are also grown: — “maguey” or “cabuya” (*Agave americana*), “pita” (*Agave* spp.), etc. (See also under PALMS).

OIL PLANTS: — Many fruit trees and palms yield oils and vegetable fats (see under these headings). Particular mention should be made of the following: — “caparrapi” or “arbol de aceite” (*Laurus exaltata*), which gives an oil used for medicinal purposes; “laurel olio” (*Myrica parviflora*) and “laurel aguacatillo” (*Ocotea longifolia*), which gives a kind of wax or vegetable tallow with which soap and candles with a pleasant natural scent are made; “otovo” and “caraño”, which yield the “otovo” and “caraño” medicinal fats; etc.

SAFONIN PLANTS: — “chubimbo” (*Sapindus saponaria*) and “friea platos” (*Sapona-ria* sp.) should be mentioned. Besides saponin, both give a wood of fairly good quality.

PLANTS YIELDING DYES: — Many plants containing colouring matter are found in the woods, but the names of many of them are unknown. Amongst those which have been most studied are: — “brasil”, “achiote” (*Bixa Orellana*); “campeche” (*Haematoxylon campachianum*); “tinte”, “drago” (*Croton gossypifolius* = *C. sanguifluus* and *Croton celti-folius* = *C. sanguis-draconis*); “dividivi” (*Caesalpinia [Coulteria] tinctoria*), “mora” (*Chlorophora tinctoria* = *Machura tinctoria*); “azafrán” (*Scoberdia asperifolia*); “anil” (*Indigofera tinctoria*); “cuscuba”; etc.

RUBBER, GUM AND RESIN PLANTS: — The wild forest plants (most of which are as yet unexamined from a botanical point of view) produce a rubber of excellent quality, which is exported chiefly to Brazil, Venezuela and Peru. Among the resin plants, special attention should be drawn to the “anime” (*Polymnia pyramidalis*), which produces an abundant flow of white transparent resin which burns with a smell of incense.

STIMULANT, AROMATIC, NARCOTIC, MEDICINAL AND POISONOUS PLANTS: — Columbian coffee is of a high quality, more particularly that of the eastern zone, in the watershed of the Orinoco, and has a very delicate aroma. The cocoa is also distinguished by its quality.

The commercial use of “sarrapia” (*Dipteryx odorata*) and vanilla (*Vanilla planifolia*) is of recent origin and has a great future before it. Many other varieties might be used for the extraction of aromatic essence.

“Guaco” (*Mikania amara* = *M. guaco*) should be placed in the front rank of MEDICINAL

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PLANTS. "Guaco" contains a febrifugal alkaloid which both prevents and cures the poisoning arising from the bites of serpents and other poisonous animals. The following plants are also found:—various species of cinchona; cassia; "gualanday" (*Jacaranda Caroba*); coca; "ipecacuana" (*Uragoga granatensis* = *Psychotria ipeacuana* ?); rhubarb; "arnica" (*Senecio crepidifolius*); "matico" or "cordoncillo" (*Piper [Artanthe] Bredemeyeri*); "alce" or "acibar"; "aconite"; "senna"; "jaborandi"; "digitalis"; opium poppy; etc. The "agráz" (*Vitis caribaea* = *V. tiliacfolia*) and the "batatillo" (a species of *Aristolochia*) yield a medicinal sap; the "perico" and the "sande" give a milky sap whose composition is very similar to that of cow's milk; etc.

The Columbian flora is also very rich in POISONOUS PLANTS; some of the most toxic are: the "manzanillo" (*Hura crepitans*); "barbasco" (*Piscidia Erythrina*), whose branches, crushed and thrown in the water, thus killing the fish, are used for fish poaching; "valdivia" (*Picrolemma Valdivia*), whose fruit is poisonous; "borrachero" (*Brugmansia lactea*), whose fruit, when macerated, yields a tasteless liquid which, when drunk, causes torpor, anæsthesia, loss of mental faculties and death.

FRUIT TREES:—These are divided into groups according to whether they are used for their wood or not:—

HARD-WOOD FRUIT TREES:—"Algarrobo" (*Hymenaea Courbaril*), "yolombo" (unspecified Myrtaceæ), "coco de mico" (*Lecithys longifolia*), give fruit with very hard shells used as utensils, and wood (especially that of the first variety) used in the manufacture of parts of machinery; "caña fistula" (*Cassia moschata*) and "tamarindo" (*Tamarindus indica*) give wood of a superior quality; the orange, lemon and citrus trees give a fine yellow wood; "guayabo" (*Psidium dubium*), "arrayán" (*Myrtus microphylla*), "guayabo negro", "guayabo arrayán", "guayabo agrio" (unspecified Myrtaceæ), "nigüito" (*Melastoma laccigatum*), "mortiño" (*Ardisia lepidota*), "mirto" (various Myrtaceæ) "caimo" (*Lucuma Riricoa*), "caimito" (*Vismia latifolia*), besides a fruit which is moderately appreciated, also yield wood of excellent quality. Of the shrubs, the pomegranate and coffee tree supply a very good wood.

SOFT-WOOD FRUIT TREES.—"cacao" (*Theobroma Cacao*); "matalotage" (unspecified Malvaceæ); "madroño" (*Rheedia madruno*); "cirpe" or "camairón" (*Pourouma sapida*) which has an exquisite wild fruit growing in large black clusters; if cultivated this fruit could be used for the production of a fermented drink similar to wine; "aguacate" (*Persea gratissima*); "níspero" (*Achras Sapota*); "mamey" (*Lucuma Bouplandia*); "chirimayo" (*Anona cherimolia*); "anón" (*Anona squamosa*); "guanabano" (*Anona muricata*); "tocay" (*Caryodendron orinocense*), from whose nuts a very delicate vegetable butter may be extracted; "mango" (*Mangifera indica*); "guamo" (*Juga spp.*); "pomo" or "pomarosa" (*Eugenia jambos* = *Jambosa vulgaris*); "morera" (*Morus spp.*); "castaño" (*Sterculia rugosa*); "brevo" (*Ficus carica*); "almendro" (*Terminalia Catappa*); "merey" (*Anacardium occidentale*); "mamoncillo" (*Melicocca bijuga*); "árbol del pan" (*Artocarpus incisa*); "ciruelo" (*Spondias purpurea*); "hobo" (*Spondias lutea*); "totumo" (*Crescentia cujete*); "hicaco" (*Chrysobalanus Icaeo*); "tomate de árbol" (*Solanum galeatum*); "perillo" or "árbol de leche" (unspecified Apocynaceæ); "olivo" (*Myrica polycarpa*); "carate" (*Bomarea multiflora* = *B. Bredemeyeri*); numerous other fruit trees.

All the European fruit trees may be successfully cultivated in the temperate or cold zones of Columbia.

FRUIT TREES NOT USED FOR THEIR WOOD:—The most important of these is the "plátano" (*Musa paradisiaca*), whose green parts may be used as a food for cattle. Among the numerous other trees of this class may be mentioned:—"papaya" (*Carica Papaya*); "papayelo" (various Aroids); "uvito" (*Nertera depressa*); "piñas" (various Bromeliaceæ); "piñuela" (*Karatas Plumieri* = *Bromelia Karatas*); "uchubas" (*Physalis peruviana*); "cortapicos" (unspecified Cactus); "durumocas" (*Saurauja ursina*); "granadilla" (*Passiflora ligularis*); "gulupas" (*Tassonia pinnatistipula* = *Poggenдорffia rosea*); "pitahayas" (va-

rious Cacti); "moras" (*Conostegia* spp.); strawberry plants; melons; various Cucurbitaceae ("ahuyamas", "calabazas", "vitorias").

#### TIMBER TREES:—

TREES WITH WOOD OF GREAT HARDNESS:— "Tibar" (*Escalonia discolor* = *E. Tubary*), a Saxifragaceae with a dark red wood which polishes beautifully; when buried, this wood resists the action of soil agents for centuries; "guayacán" (*Guaiacum* [*Lygophyllum*] *arbo-  
reum*), with a reddish-brown wood with lighter streaks; it has the same characteristics as the preceding tree; "diomate" or "marfil vegetal" (*Astronium graveolens*), which gives a wood of a fine dark red with black stripes, which polishes well; the wood neither cracks nor warps, it is not attacked by insects and does not rot; "istapa" or "árbol piedra", an undetermined species with a dark yellow wood; "huesito" (*Banara ibaguensis*); "zápan", an undetermined species which gives a beautiful lemon-yellow wood with undulating red and pink bands; "surilico", unspecified Leguminosae with a dark red wood; "arenillo" (*Hura crepitans*).

TREES WITH WOOD OF A HARDNESS EQUAL TO THAT OF THE OAK:— "Comino" (*Alouea peruvilis*), a Lauraceae which supplies one of the best woods for general purposes in Columbia; it is of a greenish-yellow colour and may be used for cabinet-making, furniture-making and railway sleepers, etc.; "Caunce" (*Godoya antioquiensis*), a Lauraceae whose wood is perhaps the most flexible known; it is yellow and polishes well; "Punte" or "nocuito", an undetermined species, its wood of a reddish-brown does not rot, and is used in the construction of very durable fences; "laurel-cacho" (*Xylosma prunifolium*), a Bixaceae which supplies one of the most useful woods for mining districts, where it is used in the manufacture of utensils for washing gold and for many mining tools; it neither cracks nor warps when placed alternately in water and in the sun; "Mangle" (*Rhizophora mangle*), "encenillo" (*Weinmannia tomentosa*), "noro" (not identified), "roble" (*Tabebuia* [*Tecoma*] *pentaphylla*), all have not only very strong ad resistant wood (unfortunately subject to cracking and warping), but also bark which is used for the extraction of tannin, in which it is very rich.

TREES WITH WOOD OF A HARDNESS EQUAL TO THAT OF THE AMERICAN PINE:— "Magnolia" or "caoba" (*Swietenia Mahagoni*); "canelo" (unspecified Bignoniaceae, with a reddish-brown wood) and "nogal" (*Cedrela Nogal*), much used in cabinet-making; "cedro" (*Cedrela odorata*) and "pino colombiano" (*Podocarpus taxifolia*), used for land and sea building purposes and as timber; "canta gallo" or "pata de gallo" (*Psammisia* [*Thibaudia*] *jalcata*), specially adapted for the manufacture of utensils for holding liquids; "tunoso" (unspecified Melastomaceae) of a beautiful lemon-yellow colour; "tuno" (*Delostoma* [*Codazeia*] *rosca*); "espino" (*Barnadesia spinosa*); "chagualo" (*Calophyllum longifolium*) and "yayo" or "hayo" (*Trichillia appendiculata*), which make excellent beams for building purposes; "chingalé", which makes very good beams; "pimiento" or "muelle" (*Schinus molle*); "cucharo" (*Myrsine popayanensis*); "eucaliptus" (*Eucalyptus* spp); "alcaparro" (*Cassia tomentosa*); "chaparro" (*Curatella americana*); "sicomoro" (unspecified); "abeto" (*Abies* spp.); "olmo" (*Ulmus campestris*); "susca" (unspecified); "quebrabarrigo" (*Godoya splendida*); these last 10 varieties produce ordinary wood which may be used for general purposes; "ceiba" (various Bombaceae, very abundant in the Columbian flora) and "caracolí" (*Anacardium rhinocarpus*), whose wood makes very good paper; "guasco" or "guacaco" (unspecified Combretaceae) and "coco de atar", whose bast, cut into strips called "guascas", is used as straps and for buildings houses with thatched roofs; "sauce" (*Tessaria mucronata*); "higuerón" (*Ficus anthelmintica* = *F. glabrata*) and other related species; many other trees giving ordinary wood which is much used.

TREES WITH VERY SOFT WOOD POSSESSING SPECIAL PROPERTIES:— "Balso" (*Ochroma tomentosa*), a Sterculiaceae supplying a wood whose density does not reach 0.100, and is much used for building rafts; it also yields a vegetable wool used as stuffing; "bucano" (*Erythrina umbrosa*), an excellent shade tree for cacao and coffee plantations, etc.

PALMS:— "Coco" (*Cocos nucifera*), "corozo" (*Elaeis melanococca* = *Alfonsia oleifera*), "mararay" (*Martinesia caryotefolia*), "chonta" (*Bactris elatior*), "cuesco" (*Attalea amyg-*



*dalina* = *A. nuciifera*), "cahipay", and "cucurito", yield fruit and oils; "dátil" (*Phoenix dactylifera*) and "palmicho", bear fruit; "tagua" (*Phytelphas macrocarpa*), gives a vegetable ivory the exportation of which increases continuously; "palma de cera" (*Ceroxylon andicola*) produces a vegetable wax; the very long, straight, hollow trunks are much used as water pipes; "noli" (*Elæis oleifera*?) supplies the best bait; "cumare" (*Bactris setosa*) supplies the finest and most beautiful vegetable fibre known, used in the manufacture of very fine and durable linens; "iraca" (*Carludovica palmata*), the fibre of which is used in the manufacture of true "panama" hats; "macana" (*Brunfelsia Hopeana* = *Franciscea uniflora*) with black wood, and "corneto" (*Iriarteia cornuta* = *Beckeria corneto*) sometimes reach a height of 180 feet; "palma cobija" or "llanera" (*Copernicia tectorum*), "moriche" (*Mauritia flexuosa*), "sarare" or "saray", "cubarro", "palma amarga" (*Oreodoxa oleracea*), "mapora" (*Trithrinax mapora*), "palma real" (*Oreodoxa regia*), "Santa Inés", "rabihorcado" (*Carludovica Wallisi*), "palma de vino" (*Cocos butyracea*), and many other varieties give wood which is used for building and fruit used for fattening pigs.

Some ARBORESCENT FERNS, especially the variety called "boba", supply stakes used in building.

531 - **Hybrid Origin of Cultivated Lucerne.** — TRABUT, in *Comptes Rendus de l'Académie des Sciences*, Vol. 164, 1st. Half-Year, No. 16, pp. 607-609. Paris, April 16, 1917.

The value of *Medicago sativa* Linn. as a species has been considered from various points of view. Certain botanists, struck by the great number of forms intermediary between lucerne and *Medicago falcata*, place *Medicago sativa* and *M. falcata* Linn. in one species. This has caused *M. falcata* to be considered as the wild form of lucerne. It is admitted nowadays that the two Linnaean varieties are quite distinct, but connected by a series of fertile hybrids which are capable of reproduction with a certain fixity.

The study of the *Medicago* members of this group which grow wild in North Africa, and of many cultivated forms grown at the Botanical Station of the Government of Algeria, has lead the author to a different conclusion:

All cultivated lucernes are of hybrid origin. *Medicago sativa* Linn., properly so called, does not exist in the wild state. In the north of Africa, Asia Minor, southern Russia, the Caucasus, Persia, Afghanistan and part of India, there are species of *Medicago* which, though always considered as the wild form of *Medicago sativa*, are, in reality, one of its parents. In Algeria these species are represented by *M. getula* Urban and *M. tunetana* Murbeck.

The cultivation of these wild lucernes gives plants which have only a medium feeding value. The flowers vary in colour and may be yellow, blue, pink or white. As they usually grow in districts very different to those in which lucerne is cultivated, in shallow soil, on tufa, the roots are not very deep, and the plant gives off rhizomes which are sometimes of great length; this never occurs in cultivated lucernes.

*Medicago falcata* does not exist in the north of Africa; it has, therefore not been produced by hybridisation, and *Medicago getula* and *Medicago tunetana* have been kept pure.

Since the colonisation of the Setif plain, however, *M. getula* has come in contact with cultivated lucernes and reciprocal fertilisation has been



inevitable in some cases. This has resulted in a local lucerne called "Setif lucerne" (1). This would explain how MR. W. OLIVER of the United States Department of Agriculture Bureau of Plant Industry was able to isolate about 50 forms of lucerne from *Medicago sativa* seeds gathered in the Setif district.

Plants grown by the author from seeds gathered at a distance from cultivated fields, sometimes at a height of 6 000 feet, in the Aures, only gave progeny which were identical with the parents, of weak growth and of little use as fodder.

*Medicago falcata*, together with the secondary forms, *M. ruthenica*, *M. glutinosa* and *M. platycarpa*, is a more northern form. It is, however, found over a very wide area, and, in some districts, might easily coincide with the *Medicago* generally held to be the wild form of *M. sativa*. It is probably the hybrids, whose growth is often very luxuriant, produced by the contact of these two varieties, which have been cultivated and have eventually become *Medicago sativa* Linn. The forms most closely related to *M. falcata* have been classified by PERSOON under the name of *Medicago media*.

Uncultivated forms of *Medicago media* are abundant in the valley of the Loire, where the true *M. falcata* is not found. Some of these are difficult to distinguish from cultivated lucerne, and it is probable that they are all derived from cultivated *Medicago sativa*.

If cultivated forms of lucerne are carefully studied, a great difference between them is seen at first sight, and traces of the influence of *M. falcata* are found in practically every variety.

This hybrid origin of cultivated lucerne explains the great facility with which it varies in different climates and rapidly forms local varieties with very diverse characteristics.

At the above-mentioned Station, Arabian lucerne (2) flowers very early, so that an extra harvest is obtained. Peru lucerne (3) is also very early. Turkestan lucerne (4) is composed of very diverse individuals, which should be isolated; it gives a very medium yield. In Australia (5) lucerne has already formed a local variety whose yield is very superior to that of recently imported seed of the same origin.

If it is desired to obtain seed of a selected variety of lucerne, the work must be carried out in a district where neither *Medicago falcata* nor *M. media* exist in the wild state. In order to form a field of stock plants, cuttings may be taken from selected individuals; by this method the necessary seed for more extensive sowing is soon obtained. By isolating varieties of *Medicago sativa* the cultivation of this valuable fodder plant would be greatly increased. In cold or barren districts, *Medicago getula* could be used in

(1) See B., 1912, No. 655.

(Ed.)

(2) See B. 1912, No. 655.

(Ed.)

(3) See B., 1915, No. 138.

(Ed.)

(4) See B., 1911, No. 445.

(Ed.)

(5) See B. 1915, Nos. 498 and 1033.

(Ed.)

crossing and would transmit to some of its progeny its peculiar characteristic of giving off rhizomes.

An attentive and prolonged study should also be made of *Medicago falcata* and the hybrids which resemble it most closely in order to obtain new forms for use more particularly in northern countries.

In short, the experimental study of wild and cultivated varieties of lucerne shows that, in the wild state, there are 2 primitive species, *Medicago falcata* and *Medicago getula*; the latter is known under other names which may be considered synonymous (*M. coerula* Less. and Lebed; *M. contorta* Gib.; *M. tunetana* Murbeck). *Medicago sativa* Linn. is descended from these two wild types by hybridisation; it includes all the innumerable forms intermediary between the 2 wild varieties and, with proper care, should supply very numerous varieties of lucerne capable of giving profitable yields under varying soil and climatic conditions.

532 - The Formation and Disappearance of Saccharose in the Beet. — COLIN, H. in *Revue générale de Botanique*, Vol. XXVIII, Parts 334, 335, 336, pp. 289-299, 322-328, 368-380; Vol. XXIX, Parts 337, 338, 339, 340, pp. 21-32, 56-64, 89-96, 111-127. Paris, 1916-1917.

The author has studied the problem of the formation and distribution of saccharose in the beet in the light of data obtained from scientific literature and his own observations. The following essential facts are either established or confirmed: —

#### 1ST. YEAR BEETS.

The leaf invariably contains a mixture of saccharose and reducing sugar composed of glucose and laevulose. Laevulose is more abundant than dextrose in the tissues of the blade, but in the petiole, especially at the base, glucose is present in greater quantities than laevulose.

The saccharose seems to originate in the leaf cells exposed to the light. In darkness it disappears after being transformed into invert sugar by the action of the sucrase which is always abundant in the blade. The ratio of saccharose to reducing sugar decreases continually from the blade to the neck, so that, in the immediate neighbourhood of the root, the sugar present in the petiole is composed of a small quantity of saccharose and a large proportion of reducing sugar, mostly glucose. There is always a large amount of reducing sugar in the stump, but it varies according to the variety of the beet, being greater when the root is young.

With regard to the origin of the sugar in the root, A. GIRARD's theory of the migration and storing of the saccharose as such has been proved unsound, 1) because the stump always contains reducing sugar, 2) because the disappearance of the saccharose from the leaves during the night is not necessarily connected with its migration towards the stump. LOEB's indirect argument in favour of the same hypothesis is based on the absence of a synthesising ferment in the stump. This can only be seriously considered if it is first proved that all polymerisation in the living tissues involves the action of a ferment. The theory of the polymerisation of the reduc-



ing sugar in the root has not yet been conclusively proved, and many difficulties stand in the way of its acceptance. The chief of these is the sudden change observed in the composition of the sugar mixture when the neck is first invaded. This proves that only a small number of the cells of the neck participate in the condensation of the reducing sugar.

There are no data as to the change the reducing sugar undergoes in the root. This condensation cannot be due to the action of a synthetising sucrase, as, under normal conditions at least, invertine is absent from the root.

## 2ND. YEAR BEETS.

Under certain conditions the sugar may leave the stump and ascend towards the aerial parts. This occurs, for example, when the beet grows in darkness, and especially in the second year when the stem is forming.

The saccharose does not at any moment hydrolyse in bulk in the interior of the stump, but the amount of reducing sugar remains perceptibly constant so long as the tissues are intact. The saccharose, when it migrates, leaves the root as saccharose and is gradually inverted as it comes in contact with the cells of the stem, the petioles and the blades. Thus the ratio between the saccharose and the reducing sugar decreases almost regularly from the neck to the top of the inflorescence.

## PRACTICAL CONSIDERATIONS.

The conditions under which the sugars develop in the leaves and the circumstances which favour the growth of the beet and its richness are still insufficiently defined. No systematic experiments have yet been carried out which allow the classification of the 3 factors, moisture, heat and light, in order of the importance of their action on the growth of the beet. All that is known is that the beet is richer in East Prussia and Holland than in Italy and Hungary, and the beet may, therefore, be said to be a northern plant. It is, moreover, impossible to state wherein lies the great difference between a sugar beet and a mangold. The root of the mangold is larger, poorer in saccharose, but richer in reducing sugar. The phenomena of development and of the accumulation of sugar are, however, essentially the same in both cases.

The peculiar properties of different varieties of beet have frequently been attributed to the leaves alone. As a matter of fact, the tissues of the stem also vary, whereas leaves of different varieties often contain the same amount of reducing sugar and saccharose.

In selection the roots richest in sugar are chosen for propagation. This is in agreement with the method always adopted in selection; the subjects showing the highest development of the required characteristic are chosen for reproduction.

Comparative data on the formation of saccharose in other plants are given.



533 - The Influence on Germination of the Hot Water Treatment of Cereal Seeds for Smut. — LAKON, GEORG, in *Zeitschrift für Pflanzenkrankheiten*, Vol. 27, Pt. 1, pp. 18-25. Stuttgart, February 15, 1917.

The experiments described were carried out in order to determine the effect, if any, of the treatment of seeds with hot water against smut on their germinating power, apart from the effect on the smut itself.

The germinating capacity of untreated barley at ordinary temperature on blotting paper was first determined; it was as follows: —

	Germinating capacity after		
	3 days	10 days	14 days
Experiment I . . . . .	23 %	94 %	57 %
Experiment II . . . . .	19 %	93 %	97 %

At a lower temperature (10-12° C.) the germinating capacity of the same barley was: —

	Germinating capacity after		
	3 days	10 days	14 days
Experiment III . . . . .	50 %	99 %	99 %
Experiment IV . . . . .	59 %	99 %	99 %
Experiment V . . . . .	57 %	98 %	98 %

Germination is, therefore, more rapid and better at the lower temperature than at ordinary temperature. These experiments show that the embryos of the seeds were only incompletely ripe.

The determination of the growing capacity (Triebkraft) of the same barley gave the following values:

	Growing capacity
Experiment VI . . . . .	76 %
Experiment VII . . . . .	72 %

A sample of the same barley was treated with hot water and the seeds germinated while still moist. The germinating capacity was:

	Germinating capacity after		
	3 days	10 days	14 days
Experiment VIII . . . . .	43 %	84 %	87 %
Experiment IX . . . . .	48 %	83 %	85 %

In 3 other experiments the seeds were dried after being treated with hot water; in two cases germination took place at normal temperature, in the 3rd., at a lower temperature. The results were as follows:

		Germinating capacity after		
		3 days	10 days	14 days
Normal temperature	Experiment X . . . .	78 %	97 %	98 %
	Experiment XI . . . .	83 %	95 %	96 %
Lower temperature	Experiment XII . . . .	74 %	94 %	95 %

CONCLUSIONS. — 1) In all cases treatment with hot water increased the germinating capacity.

2) In spite of the increase in germinating capacity, the final result of the germination of moist seeds was much inferior to that obtained with seeds which had not been treated.

3) Seeds dried after treatment with hot water and germinated at ordinary temperature showed a germinating capacity not usually found in German barleys; the final result of germination corresponded to that of untreated seeds. Lower germinating temperature had an unfavourable effect on the germinating power.

4) Soaking the seeds after drying can, therefore, eliminate the phenomena which arise from incomplete maturity; treated seeds behave in a similar way to very ripe seeds.

The growing capacity of the seeds treated was also determined and gave the following results:

	Growing capacity
Experiment XIII, with moist seeds . . . . .	21 %
Experiment XIV, with dried seeds . . . . .	63 %

If the moist seeds are sown immediately after soaking the growing capacity is impaired. Most of the few plants which put out shoots did not live owing to defective development of the roots. On the other hand, seeds dried after soaking were remarkable for their strong growth, which, however, was still inferior to that of unsoaked seeds. The experiments on the growing capacity of the plants have a relative value only.

To sum up, the treatment of the above mentioned unripe barley with hot water followed by drying, greatly increased the germinating capacity, but slightly decreased the growing capacity.

For purposes of comparison ripe barley of the same variety was treated with hot water. A considerable decrease in germinating capacity and a marked deterioration in the final results of germination were observed. The growing capacity had also decreased.

534 - **Oxidation and Reduction Phenomena in Plant Tissues.** — I. WOLFF, JULES, Mechanism of the Reaction; II. WOLFF, JULES and ROUCHELMANN, NADIA, On the Presence in a Large Number of Plants of a Diphenol greatly resembling Pyrocatechine. — *Annales de l'Institut Pasteur*, Vol. XXXI, No. 2, pp. 92-95; 96-105 + III plates. Paris, February 1917.

I. — The author shows how a blue reaction may be obtained in the presence of pyrocatechine, laccase and acetic acid by the use of potassium iodide and starch. This blue colouration is due neither to the presence of peroxides nor to that of nitrites, but is the result of a complex phenomenon in which a phenol compound plays the principal part.

II. — In a large number of plants was found a phenol compound, which, in the presence of laccase, acetic acid, and potassium iodide and starch, had an action similar to that of pyrocatechine, with which it also had other properties in common, such as: 1) the formation, with dilute ferric perchloride, of a blue-green precipitate turning to violet on the addi-



tion of a drop of ammonia; 2) red colouration with Millon's reagent; 3) no oxidation or reduction in the presence of tannin; etc.

The blue reaction can rarely be observed in the vegetable tissues or juices by the direct use of an iodine reagent. This is due to: 1) the too rapid and complete oxidation during the pounding of the oxidable substances of the plants under the influence of their own laccase; 2) the presence of traces of tannin which inhibit the reaction.

In order to avoid as far as possible these inhibitory influences, a method was devised by which the oxidation of the phenol compound (choromgene) by the laccase during pounding was prevented and the active substances in the juice set free. To attain this end the pounding was carried out in the presence of a weak solution of sulphuric acid, which prevents the action of the oxidase.

By this method 229 species belonging to 59 families were tested, and the results are summarised in table form. From the results obtained it seems that: 1) vegetable juices contain no peroxide; 2) to obtain a positive result the presence of an oxidase — laccase — is required.

The experiments led the authors to the following general conclusion: "In face of the numerous discussions on the existence of peroxides and nitrites in plants and the eventual harmful action of peroxides, we consider it useful to show that, in the majority of cases, the reaction in question is due to the presence of a phenol compound (probably pyrocatechine). Together with the laccase of GABRIEL BERTRAND, this plays an important part in the phenomena of oxidation and reduction in plants".

**535 — Pure Lines in Self-Fertile Plants Probably Unalterable by Selection.** — FRUWIRTH, C., in *The Journal of Heredity*, Vol. VIII, No. 2, pp. 90-94, 1 fig. Washington, D. C., February 1917.

The truth of JOHANNSEN's statement that selection is powerless to change the hereditary factors in a pure line, was called in question by BELLING (1) CASTLE (2) and by A. and C. HAGEDOORN (3), but it has been confirmed by the experiments of the writer. The latter has studied 3 kinds of characters:

A. — External characters showing qualitative variation (*Phaseolus vulgaris*, *Sinapis alba*) or small quantitative variations (*Pisum arvense*, *Lens esculenta*).

B. — External characters showing very large quantitative variations (oats).

C. — Internal characters showing very large quantitative variations (oats).

The plants studied were always bagged before flowering in order to insure self-pollination. The following is a summary of the most important results:

1) The variety of *Lens esculenta* known as the "Krainer Linse" (Carniola lentil) produces on the same plant 2 types of seed: a) of a uniform

(1) Cf. *American Breeders' Magazine*, III p. 311.

(2) Cf. *The Journal of Heredity* V, p. 93.

(3) Cf. *American Breeders' Magazine*, IV, p. 165.



brown colour; b) brown spotted with black. In 8 generations of selection, the writer failed to isolate plants with seed of one type; nor did he succeed in altering the proportion of the two types of seed.

2) In 9 generations of selection, similar results were obtained with a variety of *Vicia sativa* bearing both green and creamy seeds.

3) The Green Chevrier variety of *Phaseolus vulgaris* ("Snap bean") produces 3 types of seed on the same plant: a) entirely green; b) entirely white; c) green and white. In 9 generations of selection, the writer did not succeed in increasing the percentage of whole green seeds.

4) In 10 generations of selection of a fodder pea (*Pisum arvense*, called in the United States the "Canada pea") which has yellowish-green seeds with sometimes a touch of violet, it was found impossible to obtain a larger proportion of seeds with the violet tinge.

5) In 6, 7 and 8 generations of selection of the Puy lentil (*Lens esculenta*) bearing green seeds marbled with black, the marbling being sometimes so intensified as to produce an almost solid black seed, the writer failed to obtain plants which would transmit the full black colour of the seeds, or even an intensive marbling; nor did he succeed in preventing seeds with intensive marking appearing from time to time in the case of plants producing usually only normally marbled seeds.

6) *Sinapis alba* has normally light yellow seeds but some plants bear brown seeds, and others seeds of both colours. It was not possible in 6 generations of selection of plants with seed of one colour to establish full heredity of either of the colours.

Here were 6 careful and persistent attempts to change the character of a pure line by selection of variations in one direction. Therefore the pure lines seemed to be unchangeable by selection.

B. — In the "Fichtel Mountain" variety of oats the outer kernel may bear a bristle, and the basis of this kernel, the callus, may bear many long hairs or very few, short ones. These two characters, "bristled" and "haired" are easily and widely modified by external conditions and can only be described by giving percentages per plant, the mean of a large number of plants of a variety or breed, or line, being determined.

By means of selection in opposite directions, the writer tried to intensify the mean percentage of bristled or haired outer kernels on the one hand, and to diminish it on the other. Starting with a plant with 5.11 per cent of bristles, he obtained after a series of 8 selections (+) a percentage of 3.14 and after 8 selections (—) a percentage of 2.65%. These results, however, are only positive in appearance, for a change in the hereditary factors, if it were produced through selection, ought to augment from year to year, if the selection is continued, and the values corresponding to the 2 series (+) and (—) should always deviate more one from another; this, however, was not the case.

C. — In order to study a so-called internal character, the writer examined in oats the percentage of 2-kernelled spikelets per plant. By selection for 6 generations, he proved that it was impossible to obtain 2 groups of

individuals with a larger or smaller percentage respectively than their parents.

Here, as in the preceding experiment, values are sometimes obtained which would seem to show that the selector's efforts had actually been effective, but these variations appear in one generation and do not increase in succeeding generations, as they would do, if it were a case of a real change in the hereditary factors.

Similar results have been obtained by KIESSLING (at Weihenstephan, Bavaria), who after 5 generations of pure-line selection, failed to increase, or diminish, the protein content of two-rowed barley.

536 - The Selection of Sea Island Cotton (*Gossypium barbadense*) in the United States. — ORLOW, W. A., in *United States Department of Agriculture, Farmer's Bulletin*, 787, pp. 1-40 + 13 fig. Washington D. C., 1916.

Sea Island cotton is remarkable for the length and fineness of its staple. It is grown extensively in the southern states of Florida, in Georgia, and on the south eastern coasts of South Carolina, where it was introduced for the first time, in 1786, from the West Indies.

Originally this cotton plant was perennial, more developed and less productive than it is to day. Intense selection has radically changed its characters, and has resulted in the formation of a cotton which is really superior to the "Upland" types. The variability, which leads to the great improvement in Sea Island cotton, necessitates the uninterrupted continuation of this work in order to prevent the degeneration of the plantations. The following method, based on the principle of individual selection, has been advantageously adopted:—

1st. year;— Those plants are chosen which answer best to the types to be created or preserved. Preference should always be given to plants with the following characteristics:—

a) Close branches, from 4 to 5 feet long; main stem strong, with 2 or 4 basal branches bearing bolls.

b) Four-celled bolls, long, compact and full to the top; they must not be too pointed. The plants whose bolls open too widely should be eliminated as this character is in correlation with short staple.

c) Staple at least 4 cm. long, strong, as uniform as possible in colour and diameter.

d) Early or late types, according to local conditions. Very early plants give a rather lower yield than late ones, which, however, in unfavourable climates, are exposed to the danger of autumn frosts before ripening.

e) Plants which are resistant to the most serious and wide-spread diseases of the district. The Rivers variety has been isolated by selection and is to be recommended on account of its great resistance to *Fusarium vasinfectum* Atk.

Once the best plants are chosen they are labelled with a number. During the harvest, the yields of each plant are compared, and the least satisfactory set aside, the fruit of about 10 to 25 plants only being kept.

2nd. year:— The seed of these 10 to 25 plants are sown separately in lines in a field surrounded by some other crop (maize, for instance), so as to prevent the pollen of other plants (Upland varieties) from being introduced.

The best line is then chosen on the basis of uniformity, but always taking the other above mentioned characters into consideration.

The seed of the other lines is collected together and forms a good stock for ordinary purposes.



3rd. year : — The seed of the best line is sown on a special plot, and the material obtained will be used the following year as "selected seed" for general cultivation.

4th. year : — The plantations must be kept in good condition, plants of little value being removed so that only the best may be kept and propagated.

Selection should form part of the customary routine of cotton growing in the same way as manuring and the cultivation of the soil.

537 - Cotton Selection in Sicily, Italy. — See No. 545 of this *Bulletin*.

538 - Seed Selection in the Cultivation of *Hevea Brasiliensis*. — CLAYTON, BEADLE and STEVENS, HENRY, P., in *Royal Botanic Gardens Kew, Bulletin of Miscellaneous Information*, No. 1, pp. 19-24, London, 1917.

In response to the enquiry of the Rubber Growers' Association as to the possibility and probable importance of seed selection in the cultivation of *Hevea brasiliensis*, the Association's resident officers in the East collected the practical and interesting data given in the above-mentioned bulletin. In the cultivation of *Cinchona*, the yield of quinine from the bark has been raised from about 3 per cent to 7 per cent, or more, as the result of planting from the seed of trees whose bark yielded a high percentage of alkaloids. Can a similar method of seed selection be applied to *Hevea brasiliensis* in order to increase the yield of rubber? The following is a summary of the most important answers to this question.

1) Planters are agreed that certain trees always produce more rubber than others. But, on the other hand, it must be recognised that yields may fluctuate, and that the occasional heavy yields from individual trees may be due to canker which in the early stages of attack stimulates the latex flow. In order to determine the yield of a tree, the daily production of latex should be noted for a long period: for at least 1 year according to M. MARSDEN.

2) The selection of the trees for seed production is facilitated by a study of the existing correlations, thus:

a) Trees should be chosen which have a smooth bark of a pink shade.

b) As in the case of the *Cinchona*, the highest percentage of alkaloids is found in the bark of trees bearing least seed, so in that of *Hevea*, there is an inverse correlation between latex yield and seed production. Therefore, with the present haphazard system there will be a tendency to select the trees producing most seed (and consequently less latex) which will cause a deterioration in the plantations. On the other hand, scanty seed production is not only found in trees with a heavy latex yield, but also in trees which are attacked by *Phytophthora Faberi*, a cryptogamic pod disease which is very prevalent. When the area intended for seed collection has been chosen, the fungus should be kept in check by continuous spraying, especially in the monsoon season.

3) Seeds should be also selected from trees of good bark-renewing ability; this is due, as is well known, to the activity of the cambium and is chiefly a question of the general health of the tree.

4) When the trees with the best general development and the high-



est yield in the plantation have been determined, the work of selection can then be proceeded with, according to 2 different methods.

a) Individual selection (by pure lines): the seed of each tree having been collected separately it should be sown in an isolated place, protected from cross-fertilisation by a belt of some quick-growing trees, such as *Albizia*. Even if cuttings are used, individual selection is a long process and the results may be negative, as the hybrid, heterozygous parent may produce varied and heterogeneous offspring with a predominance of worthless individuals. Therefore it is better to employ the following method:

b) A small area of the plantation containing trees of known yielding quality and good development should be taken. This should be carefully watched for 2-3 years, the daily latex yield being noted and the unsatisfactory trees eliminated. This would probably leave about 40-50 trees per acre. The thinning out of improductive trees decreases the risk of cross-pollinisation. Taking a widely planted area — 60 trees per acre — fully 75 per cent of the seeds would be self-fertilised, since an insect, when once it arrives at a tree, stays, and does not give itself an unnecessary amount of flying, by going from one tree to another, even if the distance between them is small. The seed collected from the best trees which remain after the unsatisfactory ones are removed, will stock the nurseries. An excess of trees up to 200 per acre should be planted, in order to leave ample scope for the subsequent work of selection and improvement.

539 — **The Improvement of Lemon Trees by Selection in California, United States.** — SHAMEL, A. D., in *The Journal of Heredity*, Vol. VIII, No. 2, pp. 75-81 + 1 Plate. Washington, D. C., February 1917.

Having secured the financial support and the collaboration of many fruit-growers in the principal citrus-growing districts of California, the writer began, in 1909, a systematic study of the bud variations, their extent and frequency, in the 3 chief varieties of lemon: Eureka, Villafranca and Lisbon.

The plan of study pursued was to mark out performance record plots containing from 5 to 100 trees in orchards where the conditions were particularly uniform and favourable for securing reliable data regarding the productivity and other characters of the trees and their progeny. Each tree was distinguished by a letter, or number, and a record was kept of its progeny, so that the offspring of any variation could be readily traced back to the parent, and its development studied from its first appearance. The buds for progeny tests from the select trees are now more than 2 million in number, which gives some idea of the extent and importance of the work.

In each of the 3 above mentioned varieties, there occur several forms differing in: habit of growth — characteristics of bloom — season and amount of production of the fruit — size, shape and colour of the fruit — thickness and appearance of the rind — amount and quality of juice — etc.

The Eureka lemon trees may be preliminarily classified under 2 heads: 1) the productive strain; 2) the shade strain. In the latter, the trees

develop a large percentage of abnormal flowers, the pistils being rudimentary or absent, so that shortly after blooming, these flowers fall, and consequently produce no fruit. The crop produced by the normal flowers ripens mostly during the autumn, while the trees of the productive strain of the Eureka variety have a strong tendency to bear fairly regular monthly crops.

The same thing occurs in the Lisbon variety, but in this case, the shade trees bear most of their crop during the spring months.

The trees of the shade strain are greatly inferior to those of the productive one, not only in yield (which is 5 times less), but also in the quality of their fruit, only 20 per cent of which is of the best grade, as against 80 per cent in the case of the productive strain.

In June 1912, the writer and his associates made a tree census of a lemon orchard containing about 16 000 trees. It was found that 3 200, or 20 per cent, of the trees were of the undesirable shade strain. In another Eureka orchard, which was 20 years old, there were only about 10 per cent of the shade trees. The increase in the number of inferior trees is due to the fact that a larger proportion of the bud wood used for the propagation of the first orchard had been cut from the shade trees rather than from the productive trees.

In addition to the 2 fundamental strains known as the shade and productive strains respectively, other forms may be distinguished which are characterised by anatomical and physiological conditions in direct correlation with productivity. In unsuccessful or unprofitable lemon orchards as many as 90 per cent of the trees have proved to belong to worthless forms.

There is no doubt that the different forms that have been recognised and classified by the assistance of a careful study of genealogical data have been propagated, in many cases unintentionally, by bud sports. In fact, it is not unusual to find on the same tree, branches bearing 3 or 4 different kinds of fruit which can be subsequently propagated by grafting.

Bud variation in the different sorts of lemon trees is much more common than has hitherto been supposed, and the continued study of this phenomenon has led to the discovery of the best means to be adopted by selectors. These are as follows:

- 1) The elimination of unproductive forms, the selector being guided by correlative anatomical data.
- 2) The selection of scions from trees which are not only distinguished by great productivity, but also by uniformity in the character of their offspring.

The tendency to produce variable fruits and foliage is more pronounced in some forms than in others and is transmitted, thus giving rise not only to undesirable varieties, but also to a distinct decrease in the crop.

Instead of creating new varieties, it is advisable to adopt *one* variety from which 3 or 4 strains may be obtained by selection. These strains should only differ in their season of heavy production, and would therefore produce crops during the whole year, thus enabling the growers to



establish a more valuable reputation among consumers, for a standard Californian lemon.

CEREALS  
AND PULSE  
CROPS

540 - Experiments with Spring Cereals at the Eastern Oregon Dry-Farming Sub-station, Moro, Oregon. — STEPHENS, DAVID E., in *U. S. Dept. of Agriculture, Bulletin* No. 498, 37 pp., 16 fig. Washington, February 19, 1917.

The Moro Dry-farming Sub-station in collaboration with farmers, has carried out tests with spring cereals over the five year period 1911-1915. Moro is situated in Sherman County, upon the rolling hills drained by the Columbia River, and about 15 miles from this latter. The elevation of the sub-station is about 2 000 feet. The soil and climatic conditions are typical of a large part of the Columbia Basin in the States of Oregon and Washington.

The average annual precipitation at Moro and neighbourhood for the past 11 years has been 11.35 inches. The average precipitation during the growing season (March to July inclusive) for the 5 year period 1911-1915 has been 3.83 inches. The average annual evaporation from a free water surface in summer, during the 7 months April to October inclusive, has been 45.07 (5-year period). \*The ratios: evaporation-precipitation, during the growth period, and evaporation-precipitation, for the whole year, are higher at the Moro Sub-Station than at those of Nephi (Utah) and Mocassin (Montana).

The average duration of the period of frosts has been 155.8 days. The average date of the last frost (32° F.) in spring has been May 2; that of the first autumn frost, October 5.

The average wind velocity has been 5.9 miles per hour. The experiments with cereals, executed at Moro, included: selection trials — crop rotation — soil cultivation. The present bulletin contains only the results of the trials of spring cereals.

*Wheat.* — Seventy-six varieties of spring wheats have been tried over periods of two years or more. During the 5 year period 1911-1915, the highest average yield was given by the variety Early Baart (22.2 bushels per acre). The selection from Koola (C. I. No. 2203-2) gave the highest three-year average yield, 27.7 bushels per acre, in the years 1913, 1914 and 1915.

The average yield of 14 varieties of common and club wheat in 1913, 1914 and 1915 exceeded the average yield of 2 durum varieties by 3.5 bushels per acre. The average yield of the highest yielding common wheat exceeded the average yield of the highest yielding durum wheat by 7.7 bushels per acre in the same period.

Milling and baking tests of several of the spring-wheat varieties grown at the Moro sub-station have been made by the Plant Chemistry Laboratory of the Bureau of Chemistry of the United States Department of Agriculture. These tests indicate that most of the varieties are as good and some are better milling wheats than the Pacific Bluestem, which is the standard spring wheat of the Columbia basin.

Date of seeding experiments with Pacific Bluestem spring wheat indicate that seeding as early in the spring as possible gives the best results.



TABLE I. — *Kernel characters and 3-year average yields of leading varieties of spring wheat grown at the Moro Sub-station in 1913, 1914 and 1915, arranged by classes, with the average yield per acre of each variety and of each class.*

Class and variety	C. I. No.	Character of kernels	Average yield per acre in bushels. 1913 to 1915
<b>COMMON AND CLUB</b>			
<i>Beardless :</i>			
Pacific Bluestem . . . . .	4067	Soft, white. . . . .	21.4
Ghirka . . . . .	1517	Soft, red . . . . .	20.7
Karum. . . . .	2200-1	Hard, white . . . . .	26.3
Little Club . . . . .	4066	Soft, white . . . . .	21.6
Marquis. . . . .	4158	Medium hard, red. . . . .	22.6
Sonora . . . . .	3036-2	Soft, white. . . . .	20.2
		<i>Average</i>	<b>22.1</b>
<i>Bearded :</i>			
Aulicata . . . . .	2407-2	Hard, red . . . . .	22.0
Chul . . . . .	2227-1	do. . . . .	21.3
Early Baart . . . . .	1697	Soft, white. . . . .	25.9
Heine Squarehead . . . . .	2669-1	Soft, red. . . . .	22.6
Koola. . . . .	2203-2	Medium hard, red . . . . .	27.7
Talimka . . . . .	2495	Hard, amber. . . . .	25.5
Yantagbay . . . . .	2404-1	Hard, red . . . . .	22.0
Zacatecas . . . . .	2799-2	Soft, red. . . . .	21.9
		<i>Average</i>	<b>23.7</b>
<b>DURUM</b>			
Black wheat . . . . .	2511	Hard, amber. . . . .	20.0
Kutabanka . . . . .	1516	do. . . . .	18.5
		<i>Average</i>	<b>19.3</b>

Rate of seeding experiments with the Pacific Bluestem variety indicate that for early spring seeding about 5 pecks per acre is the best rate. For late seeding 3 pecks per acre produced the highest yields.

*Oats.* — Of the 20 oat varieties under experiment for a period of at least 2 years, the early varieties, like Kherson and Sixty-Day have given the best results, though Siberian, a variety maturing in mid-season, has given yields practically as high as the Sixty-Day and Kherson in a 5-year average.

*Barley.* — 42 varieties of spring barley have been tested, and 5-year average yields obtained for 13 varieties. The variety giving the highest average yield in the 5 years was Mariout C. I. No. 261, a 6-rowed form, yielding 34.3 bushels per acre. The 2-rowed forms white Smyrna and Hannchen produced average yields, in the same period, of 33 and 32.2 bushels per acre, respectively.

TABLE II. — *Agronomic Data and 3-year average yields for the 11 most important varieties and selections of spring oats tested at the Moro Sub-station from 1913-1915.*

Variety	C. I. No.	Date headed	Date ripe	Height Inches	Bushel weight Pounds	Average yield per acre Bushels
Sixty-Day selection . . .	165-I-I	June 16	July 9	28	30.7	54.9
Kherson . . . . .	459	» 18	» 13	26	30.0	50.1
Sixty-Day . . . . .	165	do.	» 12	26	30.7	52.6
Siberian . . . . .	635	June 27	» 20	34	34.0	49.7
Storm King selection . .	522-I	do.	» 18	33	33.0	48.3
Canadian . . . . .	444	June 26	do	33	36.5	46.8
Local variety . . . . .	795	» 29	July 20	32	28.4	44.6
Swedish Select selection .	134-I	» 26	» 18	33	32.4	43.5
Shadeland Climax . . . .	681	July 1	» 21	32	33.3	42.3
Black American . . . . .	549	June 28	do	28	28.6	39.9
Swedish Select . . . . .	134	» 26	July 20	32	32.7	41.6

TABLE III. — *Average yield of 13 spring barley varieties, grown at the Moro Sub-station during the 5-year period, 1911-1915, inclusive.*

Variety	C. I. No.	Average yield per acre in bushels
Black Hull-less . . . . .	596	24.2
Beldi . . . . .	190	28.3
Chevalier . . . . .	200	23.6
Coast . . . . .	626	29.6
Gatami . . . . .	575	27.8
Hannchen . . . . .	531	32.2
Hanna . . . . .	24	26.5
Mariout . . . . .	261	34.3
Mahan . . . . .	1144	24.6
Manchuria (Minn. No. 105) . . . . .	576	29.6
Oderbrucker . . . . .	537	29.4
Svanhals . . . . .	187	28.5
White Smyrna . . . . .	658	33.0

TABLE IV. — *Average acre yields of all spring wheat, oat, and barley varieties grown, 1913-1915.*

Crop	Yield per acre	Value per acre
Spring barley . . . . .	1572	\$ 19.33
Spring oats . . . . .	1485	20.49
Spring wheat . . . . .	1296	17.50

*Spring emmer* has not given as good results as spring barley or oats.

The *grain sorghums* have not given profitable returns. Of the varieties tested, Manchu Kaoliang is the most promising.

The 5 year average yield in pounds of the highest yielding varieties of the three leading cereals was as follows: Wheat, 1362 pounds; oats, 1402 pounds; barley, 1646 pounds.

Based on the 10-year average farm price of these cereals in Oregon, the acre value of wheat would be \$ 18.39; oats \$ 19.35 and barley \$ 20.35.

The above tables summarise the principal results.

541 - **Studies on Wheat in the Province of Rovigo, Italy.** — BERTONI, G., in *Il Coltivatore*, Year 63, No. 10, pp. 327-332, 3 fig. Casale Monferrato, April 10, 1917.

A summary of the chief results obtained by Prof. MALANDRA, Director of the travelling Chair of Agriculture of Lendinara, from experiments described in his work "*Le varietà di frumento in Polesine*" ("The varieties of wheat in Polesine"). The work bore on the time of sowing, manuring, yield, time of ripening, resistance to lodging and rust, and the behaviour of the different varieties as regards the various physiological and parasitic diseases.

The varieties most resistant to lodging are: Nonette de Lausanne, Hybride inversable de Vilmorin, Hybride Trésor, and Gros Bleu.

As regards resistance to rust the best varieties, in decreasing order of resistance, are: Nonette, Cavallasca, Semiduro del Fucino, Gentil rosso, Rieti originario, Inversable, Gros Bleu, Hybride Trésor, No. 12 Family of Cologna Veneta, Rosso Olona.

The early-maturing varieties are (in decreasing order): Cologna Veneta (original and reproduced), No. 12 Family of Cologna Veneta, Gentil Bianco, Rieti, Rosso Olona, Gentil Rosso, Inversable, Gros Bleu, Hybride Trésor, Cavallasca, Semiduro del Fucino, Nonette de Lausanne (ripens 12 to 15 days after the Cologna variety).

542 - **Results of Trials in 1916 at the German Station for Potato Growing (1).** — VON ECKENBRECHER, B., in *Zeitschrift für Spiritusindustrie*, Year 1917, Supplementary No., pp. 1-57. Berlin, 1917.

STARCH CROPS

In 1916, on account of the war, the number of experimental fields at the above station has been reduced from 32 to 30, distributed over the same farms and districts of Germany as in 1915. The varieties tested numbered 20. Among those of 1915, the writer has eliminated: Zukunft — Geheimrat von Rümker — Attyk — Landrat von Ravenstein — Gertrud — the value of which is fairly well known.

To compensate, the following new varieties have been tested: Lothos — Mimosa — Hindenburg — Prof. Wohltmann de Cimbale — Astra — Greisitzer Prof. Wohltmann. For the varieties already tested in 1915, the seeds were derived from the 1915 experimental fields.

(1) The results of the 1914 trials are summarised in *B.*, 1915, No. 495, and those of the 1915 trials in *B.*, 1916, No. 513. (Ed.).





The size of the plots, the cultivation, manuring and harvesting were carried out exactly as in 1915.

In 1916, the weather generally was very unfavourable for growing potatoes. The dry weather in May retarded their early growth and made the crop a very irregular one. At the beginning of July the fields looked very well and there was the prospect of a good crop, but the subsequent rains hindered further development, favoured disease (*Phytophthora* particularly attacking early and mid-early varieties) and caused a faulty development of the tubers. Later, thanks to the fine spell in September, the damage was partially repaired, especially in the case of the late varieties, which were remarkable for their high starch content.

Table I classes the different varieties according to their yield of tubers and starch per hectare (1), whilst Table II compares the 1916 yields with those of the preceding years; it shows that: in 1916, the average yield in tubers was 54.5 quintals lower than in 1915; the starch content lower by 0.4 %; the starch yield lower per acre by 11 quintals. 1916 shows the lowest record of all the years in which experiments have been in progress with the exception of 1904 and 1911. The same diminution of yield in 1915 occurred throughout all the experimental fields.

All the varieties cultivated in 1915 showed a decreased yield of tubers in 1916, estimated, on the average, at 84 quintals per hectare and even reaching 107.1 quintals per acre for the Prof. Gerlach variety.

Among the varieties cultivated in 1915 and 1916, ten showed a decrease in the starch content in 1916, in two varieties the starch content had increased and in two others it had remained the same. In 1916, the maximum starch content was 20.8 %, the minimum 14 %.

With regard to the degree of resistance to disease, results are known for 19 experimental plots. The following data show the worst and least attacked varieties:

		Tubers diseased
Worst attacked	Richter's Imperator . . . . .	6.5 %
	Dabersche . . . . .	5.8
	Präsident von Klitzing . . . . .	5.7 %
	Prof. von Eckenbrecher . . . . .	4.0 %
Least attacked	Parnassia . . . . .	1.0
	Hindenburg . . . . .	1.0

Mention is also made of the different diseases (*Phytophthora*, leaf curl, etc.) in the different varieties.

With regard to the keeping qualities (cellar stored) of the 1915 crop, the following list shows comparative values:

Good to very good: Prof. Gerlach — Roode Star — Wohltmann 34 — Prof. Wohltmann — Deodora.

*Good*: Gedymin — Dabersche — Parnassia — Excellenz.

*Fairly good to good*: Boehm's Erfolg — Ursus — Prof. von Eckenbrecher — Präsident von Klitzing.

*Fairly good*: Richter's Imperator.

In conclusion, the writer gives notes on the general value of each variety (more especially with regard to those tested for the first time) and their value for human consumption.

TABLE II. — *Yields in 1916 compared with those of preceding years or periods.*

Years or periods	Average yield of tubers per hectare	Average starch content	Average yield in starch per acre
	quintals		quintals
1888-1892 . . . . .	215.6	19 %	41.2
1893-1897 . . . . .	233	18.9	43.9
1898-1902 . . . . .	251	19	47.2
1903-1907 . . . . .	235.2	18.2	42.8
1908-1912 . . . . .	227.5	18.1	41.2
1913 . . . . .	226.3	17.5	45.7
1914 . . . . .	209.5	18.3	38.7
1915 . . . . .	246.4	17.9	44.4
1916 . . . . .	191.9	17.5	33.4

543 - **Sweet Potato Culture in the United States and in Sicily.** — I. JOHNSON, T. C., and ROSA, J. T., jr. Sweet Potato Culture, in *Virginia Truck Experiment Station, Bulletin* 19, pp. 387-415. Norfolk, Virginia, April, 1, 1916. — II. BORZI, A., *The Batatas edulis* in Sicily, in *Bollettino di Studi ed Informazioni del R. Giardino Coloniale di Palermo*, Vol. III, Parts 3-4, pp. 118-127. Palermo, 1916.

I. — *Sweet Potato Culture in the United States.* — Sweet potatoes are increasing in value and importance as a commercial truck crop in the United States. The acreage under sweet potatoes increased 12.2 per cent. between 1909 and 1915. The total yield in 1915 was 74 295 000 bushels.

The value of the crop can be further increased by the use of modern storage houses, better methods of packing, and closer attention to grading.

Under the conditions obtaining in the United States, the sweet potato seldom flowers or sets seed. It is therefore propagated by cuttings, or by rooted sprouts from the tubers. Therefore it has been found that the only practical basis for the improvement of the sweet potato is the hill unit. By going through the field at harvest time and selecting the best hills, great improvement can be made in the yield and quality of the crop. The characters to be aimed at in selection are: size, shape, colour, and freedom from disease. It is necessary to select every year and for the same characters.



The numerous varieties of sweet potatoes may be divided into 2 general market types: 1) the dry, mealy-fleshed varieties generally preferred on the northern markets: 2) the moist-fleshed, sweet varieties preferred on the southern markets. The varieties best suited for cultivation in East Virginia are: Little Stem Jersey (yellow Jersey or "Up-River"), Big Stem Jersey, Southern Queen (Hayman), Nancy Hall, and Porto Rico. Other good varieties are: Triumph, Georgia, Yellow Yam, White Yam, and Pierson. Heavy yielding varieties valuable for stock food are: Key West Yam, Creola, and Red Brazil.

In Virginia, sweet potatoes are sown on a layer of sand placed upon manure. To prevent the introduction of disease into the hot bed, fresh sand should be used each season. An excellent prophylactic measure consists in treating the seed for 5 or 10 minutes just before bedding with a 0.9 per thousand solution of corrosive sublimate. The same solution may be used 3 or 4 times. The use of formalin for seed disinfection is not advised.

Transplanting tongs facilitate the work of setting. Two-horse transplanting machines are very useful in setting large areas, for they set the plants more evenly, much faster and just as well, or better, than by hand.

On the Eastern Shore of Virginia, the ridges are usually made 28 to 30 inches apart, and the plants are set from 16 to 22 inches apart. When the plants are set as far apart as 22 inches, 2 plants are usually set together in each hill.

Cultivation consists chiefly in keeping down weeds. The drill plough should first be used followed by hand-hoeing. For harvesting large areas, 2 special types of diggers are used. The best method is to cut the vines with a "vine-cutter" and the roots are then thrown out by an ordinary turn plough. During harvest and the subsequent handling of the potatoes care must be taken to avoid bruising the tubers, as when bruised they turn black and rot.

In trucking sections in the United States, sweet potatoes are usually sorted into 2 grades, primes and culls. These grades are based entirely on the size of the potatoes, everything going as primes, except the small and stringy potatoes. Occasionally a third grade is made, "extra fancy", consisting of the most select potatoes, uniformly medium-sized, regular in shape, and free from any injury. When some of the potatoes are very large, a fourth grade "Jumbo" is made. These are much sought after in some markets. The writer advises the adoption of these 4 grades.

For packing, barrels and crates are used, or what is still better, *Delaware hampers*, which cost no more than barrels, are much more easily handled and prevent the potatoes being bruised. In order to keep potatoes well, they must first be dried out of doors, or in a well-ventilated building at 29-30° C., and then kept at a temperature below 12° C. These conditions can best be attained in a specially constructed modern storage house; small quantities can, however, be kept in outdoor storage pits, where they are piled in a conical heap.

Storage in hampers is more convenient and satisfactory than storage in barrels.

Sweet potatoes are subject to many serious diseases: stem rot (*Fusarium Batatas*) — black rot (*Sphaeronema fimbriatum*) — foot rot (*Plenodomus destruens*) — scurf (*Monilochaetes infuscans*). These, however, can always be prevented by: choosing healthy tubers for planting — immersing the tubers in a 0.9 per thousand solution of corrosive sublimate — disinfecting the seeds — rotation of crops.

The Little Stem Jersey variety, which produces a good dry table potato, is especially adapted for shipping in hampers to northern markets.

II. — *Sweet-Potato-Growing in Sicily.* — The potato was introduced by GASPARRINI into Sicily in 1824 and planted in the Royal Garden of Boccadifalco, near Palermo. It is now cultivated on the north coast of the Province of Messina, the area under the crop increasing every year. The writer is of opinion that potatoes can be grown in south Italy wherever citrus trees flourish and under the same conditions of soil and irrigation.

The potato requires a fairly compact and well-aerated soil; it does very well in the sandy, fairly manured, reclaimed land on the coast. It must be irrigated, but not frequently or liberally. In very light permeable soils like those of San Filippo del Mela, Spadafora, Saponara, etc. (Province of Messina), 2 or 3 irrigations are sufficient per month from May to September. The soil is cultivated to a depth of 35-40 cm. and manured as heavily as possible; then it is cleaned, divided into plots from 1.5 to 2 m. wide by means of trenches which serve for irrigation purposes, and facilitate hoeing and ploughing operations.

The potatoes are propagated by cuttings taken from the erect portions of decumbent stems, 15 to 25 cm. long and bearing 5-10 leaves, (that is to say, by roots which are not yet completely tuberised) which have been kept from the harvest of the preceding autumn, and stored on an open dry spot. They should be placed in a single row and covered with a layer of sand, or ashes, from 5 to 6 cm. deep. The object of this method of preserving the untuberised roots is to promote bud formation which is complete towards the end of April, or early in May.

Growth reaches its highest development in summer. The harvest begins at the end of October, and continues till the end of December.

In Sicily, under good cultural conditions, 500 kg. of tubers are produced per "are". The potatoes, in normal times, sell for from 20 to 25 lire per quintal (= 16 to 20 shillings at par); in 1916, they fetched as much as 30 lire.

According to the writer, the potato should be more extensively grown in southern Italy than it is at present, and should be cultivated as a forage plant also, for not only the tubers, but also the green portions of the plant, form a good food for cattle, if they are cut at the time of harvest.



544 - Influence of the Time of Cutting on the Yield of Lucerne, in Italy. — MORETTINI, A., in *Le Stazioni Sperimentali Agrarie Italiane*, Vol. XLIX, Part II, pp. 541-562. Modena, 1916.

FORAGE CROPS,  
MEADOWS  
AND PASTURES

The best time for cutting meadow-land is known to be at the beginning of the flowering period, but it is not always possible to effect it at this time and the majority of farmers prefer to postpone the time of cutting rather than to anticipate it.

In order to ascertain whether this practice is a good one, the writer undertook to study the effect of anticipating or retarding the 1st. and 2nd. cuts upon the yields from subsequent cuts. His researches were carried out in 1914-1915 upon land adjoining the "R. Istituto Superiore agrario sperimentale" at Perugia, situated on a gentle slope and arranged in wide strips, the test plant used being lucerne grown without irrigation.

EXPERIMENTS IN 1914. — 1) A piece of land of 270 square metres was divided into 9 plots of 30 square metres each. The first was cut on April 10, the others in turn at 5 days' interval. On April 25, flowering had not yet begun; on May 1, the first buds had begun to show at the base of the stems. The following cuts were made on each plot at the beginning of flowering and before the appearance of the buds.

On the last two plots it was impossible to make a fourth cut, the growth being too thin. On none of the plots was it possible to effect a fifth cut. The results, summarised in Table I., show that the unit maximum production (74 666 kg. per hectare = 20 640 kg. of hay) was obtained on the 4th. plot.

2) It was wished to investigate the influence exercised by anticipation or delay of the 2nd. cut. For this purpose, another piece of land was utilised, divided into 8 plots of 30 sq. metres each. The first cut was made on May 10; the second on the date given in Table II; the subsequent cuts were made at the beginning of flowering. The total results, given in Table II, show that both for the first and second cuts, the best period is the beginning of flowering and that by anticipating or retarding the cutting in relation to this period, the yield obtained is lower the greater the time of anticipation or postponement.

EXPERIMENTS IN 1915. — Contrary to what was done in the preceding year, the cuts subsequent to the first one were no longer made at the beginning of the flowering on each plot, but according to the anticipation or delay in the cutting of the 1st cut, i. e. the first plots were always cut early, the others always late. With slight variations, the results obtained were similar to those of the preceding year.

Further, in order to gain a better idea of the quality of the forage, the yield of leaves and stems was determined for each plot. It was found that the percentage of stems from the 1st. cut increased from the 1st. plot (58.2 %) to the 7th. (72.2 %) whilst the percentage of leaves, as may be imagined, proceeded in inverse direction.

The same variations were noted for the 2nd. cut but less clearly.

On the other hand, for the 3rd. cut, no variations were noted in a definite direction.



TABLE I. — *Influence of the time of the 1st. cut.*

Plots	1st. cut				2nd cut				3rd. cut				4th cut				Total yield	
	Date of cut	Yield per plot		Date of cut	Yield per plot	Date of cut	Yield per plot		Date of cut	Yield per plot	Date of cut	Yield per plot		Date of cut	Yield per plot	grass	hay	
		grass	hay				grass	hay				grass	hay					
1	10 IV	65 kg	20.66 %	4 VI	50 kg	23.43 %	27 VII	51 kg	30.33 %	16 IX	15 kg	37.10 %	181 kg	45.15 kg				
2	15 "	75	21.86	12 "	56	27.00	27 "	57	27.03	16 "	18	40.00	206	55.18				
3	20 "	76	22.53	15 "	51	24.43	30 "	60	27.76	16 "	20	37.16	207	53.05				
4	25 "	84	27.13	20 "	60	23.10	1 VIII	59	29.33	18 "	21	37.16	224	61.92				
5	1 V	74	28.40	25 "	69	25.53	8 "	56	27.73	18 "	10	39.76	209	58.11				
6	5 "	72	29.33	30 "	74	24.93	12 "	55	28.33	5 VIII	9	37.33	210	58.54				
7	10 "	66	29.40	6 VII	77	26.43	17 "	47	32.06	24 "	12	40.00	202	59.61				
8	15 "	60	37.60	10 "	72	24.06	22 "	42	32.63	—	—	—	174	52.58				
9	22 "	52	33.89	15 "	75	25.66	28 "	41	32.21	—	—	—	168	50.03				

\* as % of weight of grass.

TABLE II. — *Influence of time of 2nd. cut.*

Plots	Time of 2nd. cut	Total production of 2nd., 3rd. and 4th. cuts per plot	
		green	as hay
1. . . . .	15 VI	140 kg	36.31 kg
2. . . . .	20 »	143	37.67
3. . . . .	25 »	138	35.33
4. . . . .	30 »	141	37.71
5. . . . .	6 VII	132	36.92
6. . . . .	10 »	126	37.07
7. . . . .	15 »	119	35.06
8. . . . .	20 »	80	37.10

If the cuts are delayed, the proportion of stems is thus appreciably increased which tends to render the quality of hay more ordinary, even when the continual progress of lignification is neglected. These results were confirmed by those obtained on another piece of ground.

Summarising the results obtained during the 2 years' experiments it may be concluded that:

1) By advancing or postponing the cuts of lucerne on the normal time which corresponds to the beginning of flowering no increase in the total quantity of forage is obtained.

2) The largest quantity of forage is obtained by making various cuts at the beginning of flowering and before the new buds appear at the base of the plants.

In the localities where the experiments were made, the anticipation of the time of cutting lucerne has not increased the production of forage, contrary to the results obtained in other localities (Hohenheim, Proskau, Utah) and by other workers (GAROLA, WOLFF, FOSTER and MERILL). The present writer considers that this is to be attributed to the fact that in the Province of Perugia, the amount of rainfall is insufficient to produce a beneficial effect after the time of the 1st. cut.

If it is impossible to make the cuts at the beginning of flowering, it will be less unfavourable to advance rather than to retard them; in the first case one only loses on the quantity of hay, whereas, in the second case, there is a diminution of the nutritive value also, and this decrease is greater the greater the delay.

545 — Cotton-growing Trials at the Palermo Royal Colonial Garden, Sicily, in 1915.

— *Bollettino di Studi ed Informazioni del R. Giardino Coloniale di Palermo*, Vol. III, Parts 1-2, pp. 8-17. Palermo, 1916.

In comparison with previous years, the 1915 trials with cotton-growing at the above-mentioned Garden have only given results of moderate

interest; this being on account of the exceptional conditions prevailing in that year. However, the results obtained with the following varieties are still worthy of mention: Boyd's Prolific — Toole — Mitafifi — Caravonica Wool.

The preparation of the ground, manuring, seeding and general care were the same as in the preceding year.

There was a slight variation in the production: Boyd's Prolific, unmanured, yielded 1400 kg. per hectare, or 93 kg. more than the previous year; for the other sorts the increases were rather less: Toole, 1297 kg. — Mitafifi, 1309 kg. — Caravonica Wool, 815 kg. These results were from fields which had received per hectare (except Boyd's Prolific) a manuring composed of: farmyard manure, 2000 kg. — superphosphate, 400 kg. — potassium sulphate, 100 kg.

Attention was concentrated on selection work, and the results of the experiments, if not actually decisive, are nevertheless sufficiently encouraging to merit report. The following were the characters which received most attention:

1) *Development*. — At the last seed harvest preference was given to those derived from plants of medium height, as small plants invariably give small yields, both with regard to number and size of bolls, and tall plants give a late and inferior quality crop.

2) *System of branching*. — Plants were chosen which possessed numerous basal branches and strong growth, obvious signs of higher productivity.

3) *Size of bolls*. — This character is of the greatest importance, because it is not only an invariable sign of strong and healthy growth, in other words perfect acclimatisation, but also means a high yield on ginning.

4) *Ripening of bolls*. — The complete ripening of the bolls influences the quality of the product, not only because the staple becomes longer, but also because it acquires greater tensile strength, which allows it to resist perfectly the strain undergone in ginning. The keeping qualities are also improved because the well matured cotton is drier and so keeps longer.

5) *Dehiscence of bolls*. — The more complete the dehiscence, the easier the removal of the lint, which results in reduced cost.

6) *Relative facility with which lint detaches from bolls*. — This character is important and is taken into account in selection.

7) *Number of chambers in each boll*: This varies from 3-5 and directly influences the weight of the boll itself.

8) *Colour*. — This is a character determining variations in the market price, consequently it is endeavoured to make it as homogenous as possible.

The following are characters which determine the market value of cotton, consequently they are the subject of selection:

Flexibility — lustre — length and diameter — homogeneity — fineness — tensile strength and twisting strain — elasticity — method of insertion — equal density of hair-wall.

The results of this careful and patient work of selection for the varieties tested are summarised as follows:



*Results of selection of 4 varieties of cotton*

Characters	Boyd's	Toole	Mitafi	Caravonica
Height of plant	48 cm.	42 cm.	80 cm.	140 cm.
Branching	abundant	moderate	good	abundant
Size of capsules	good	good	very good	very good
Number of capsules	14-15	10-15	20-25	180-200
Maturation	complete	good	good	late
Dehiscence of boll	complete	good	complete	mediocre
Detachment of lint	sufficient	mediocre	easy	very good
Number of chambers	4-5	4	4-5	4
Colour of staple	white	white	brown	white
Flexibility	mediocre	mediocre	very good	very good
Lustre	faint	mediocre	very good	very good
Length	28-29 mm.	26-27 mm.	38-40 mm.	45-48 mm.
Diameter	0.0201 mm.	0.02425 mm.	0.02107 mm.	0.0263 mm.
Homogeneity	very good	fairly good	good	insufficient
Fineness	good	good	good	very good
Breaking strain	very good	fairly good	very good	good
Twisting strain	very good	fairly good	very good	good
Elasticity	uniform	fairly good	remarkable	good
Twisting of fibres	homogeneous	fairly good	homogeneous	fairly good
Density of hair walls	homogeneous	fairly good	good	fairly good

It is easy to understand that such selection work cannot give immediate results; it will lead, however, to the formation of an improved Sicilian variety which will possess the 3 most important fundamental characters: good yield — staple of good quality — good resistance to drought.

The chief aim of the experiment is limited to a search for the varieties of cotton which, in the climate and soil of Sicily, may contribute to the progress of this important crop. With the pedigree method one should be able to separate from the common species a certain number of sub-species or varieties, distinct with regard to their botanical characters, but especially so with regard to their characters of economic importance.

During the next few years demonstrations will be given on the best methods of cultivation and on the varieties best adapted to the environment and market requirements.

The fields started in Catania by the Sicilian Agricultural Society Val di Savoia have already given encouraging results with regard to the extension of cotton growing in the Catanian plain.

546 — **Sea-Island Cotton Improved by Selection in the United States.** — See No. 536 of this *Bulletin*.

547 — **The False Cotton-Plant *Gomphocarpus fruticosus* in Italy.** — PASQUALE, FORTUNATO, in *Bollettino della Società Orticola Varesina*, Year V, No. 47, pp. 5-6. Varese, May 1917.

This member of the Asclepiadaceae is a shrub and a native of India. It has become acclimatised and occurs wild in Sicily and Sardinia, and also elsewhere, as in Corsica. The writer has seen it in the province of Cosenza and recollects having seen it recorded in the Vesuvius district.

It has been cultivated in the Salento district in order to extract the silky material, but no industry on a large scale has developed therefrom.

The textile material is formed by long, stiff, silky threads which surround the numerous seeds. It has the appearance of real silk but has neither its strength nor wearing qualities; its price is markedly lower.

The cultivation of this plant is capable of acquiring great importance in Southern Italy and Tripolitania, as it grows in all soils, even when arid and barren, and requires no other expenses than those of sowing and harvesting; the latter is carried out in proportion as the fruits (follicles) dehisce. As the plant is distasteful to animals it might be used for making hedges, and in view of its tufted roots, might be employed for fixing shifting soils.

Work preparatory to sowing is limited to the ordinary ploughing made after removal of weeds by a couple of turns with the weeder and another two with the harrow. Sowing is carried at intervals of 1 metre between rows and at a little less distance along the rows. The writer has established, by direct experiment, that the yield of each plant (bush 1 to 2 metres high) is about 100 follicles on the average, yielding about 25 to 30 gr. of vegetable silk. One can estimate 8000 bushes to the hectare (1 ha. = 2.47 acres) giving a crop of 160 to 240 kg., saleable at a price varying at about 2 francs the kilo (the substance is very light). The entire cost of cultivation comes to about 100 francs per hectare (£1, 12s. 1d. per acre).

## SUGAR CROPS

## 548 - Relation between Colouration and Maturation in the Sugar Cane in Java. —

SCHELTEMA, A. M. P. A., in *Archief voor de Suikerindustrie in Nederlandsch Indie*, Year 25, Part 7, pp. 189-196. Soerabaja, February 1917.

The colour of the stems of the sugar cane may differ very greatly in the same variety: in fact, these differences are sometimes so great that it is often impossible to use this colouration as a botanical characteristic in describing a given variety.

The author has attempted to establish a correlation between the stage of maturation and the colouration in the variety E K 2. Samples of green, yellow and red stems gave the following average saccharine content respectively:

	Brix Number	Sugar Content
Green stems . . . . .	16.10	7.88 %
Yellow stems . . . . .	16.98	9.48
Red stems . . . . .	16.90	9.62

These results seem to prove that the colour of the cane may give some indication of its degree of ripeness. The green cane is not yet ripe; when it becomes yellow it is already ripe, and it turns red in those places to which the light has easy access.

The author proposes to carry out similar researches on other varieties of sugar cane.

549 - Experiments on the Manuring of Tea-Plants in Java. — BERNARD, CH. and DEUSS, J. J. B., in *Mededeelingen van het Proefstation voor Thee*. Batavia, 1916.

The difficulty of obtaining exact data as to the effect of any given manure on tea plantations is pointed out. This difficulty is particularly evident during the harvest, which is carried out by women who pick the young leaves. Very minute instructions as to the method of picking are given; nevertheless, some of the women gather the very young leaves, whereas others mix more or less old leaves. As the experimental plots are not always harvested by the same workers, there is a fairly large error in the results. For other reasons as well, the results of the experiments have only a relative value. Tests carried out under the conditions described above, however, give valuable data on the question of manuring tea plants, especially if the results are applied locally and general conclusions are not drawn.

In an experimental field, peanut cake + bone meal gave more satisfactory results than cake + superphosphate. This last manure seems to lose its activity more rapidly. Complete manure did not give such good results, probably on account of the detrimental action of the mixture of a natural manure, such as cake, with a chemical manure, such as potassium nitrate.

The Table given below shows the extra yield obtained with the manures.

	Manure	Increased Yield percentage
Fairly old plantation	Peanut cake . . . . .	11.50
	Idem + bone meal . . . . .	14.00
	Idem + superphosphate . . . . .	7.03
	Other fertilisers . . . . .	up to 5.50
Younger plantation .	Phospho-nitrogenous fertiliser . . . . .	15.90
	Phospho-potassic fertiliser . . . . .	27.70
	Complete chemical fertiliser . . . . .	34.40

In another experimental field, a fertilising mixture frequently used in the tea plantations of Ceylon gave an increased yield of 3.8 %. The yield must, however, be controlled for at least one year before definite results can be obtained. Moreover, no conclusive results were obtained from some of the fields which were ravaged by the insect: *Helopeltis Antonii*.

The results of manuring experiments in a large tea plantation are given. There was a marked increase in yield, but a decrease in the quality of the leaves. Attempts were made to render the plants more resistant to the attacks of insects. With this end in view each plant was treated every two years with a manure composed of: 50 gr. peanut cake, 3 gr. double superphosphate and 2 gr. potassium sulphate. The results were satisfactory.

STIMULANT,  
AROMATIC,  
NARCOTIC  
AND MEDICINAL  
PLANTS



## 550 - The Cultivation of Aromatic Plants on the Southern Crimean Coast, Russia. —

Вульфъ Е. В. (VOULF, E. V.), Пигулевскій Г. В. (PIGOULEVSKI, G. V.) and Альбрехтъ Э. А. (ALBRECHT, E. A.), in *Ботаническій Кабинетъ и Ботаническій Садъ Императорскаго Никитскаго Сада* (Botanical Laboratory and Garden of the Nikitskii Imperial Garden), No. 3, pp. 41. Ialta, 1916.

In view of the favourable soil and climatic conditions of the southern Crimean coast the propitiousness of the present time for increasing the cultivation of aromatic plants there, and the lack of information on this subject, the Nikitskii Botanical Garden undertook a series of experiments in order to obtain exact data with regard to the cultivation of such plants.

MR. VOULF investigated the yield in essential oils of the following plants: — *Rosmarinus officinalis* L., *Laurus nobilis*, L., *Salvia grandiflora* Ettling, *Lavandula spica* D. C., garden plants; *Hyssopus officinalis* L., a wild plant of the south coast of the Crimea. As suitable apparatus was not available, the distillation of the plants was carried out in a primitive manner by the use of 2 flasks, in one of which was produced the steam necessary to carry the essential oils contained in the plants over into the other flask. The liquid was condensed and the essential oils separated from the water by means of a separating funnel. The appended table gives a summary of the results obtained.

## Results of Distillation Experiments.

Plantes distilled	Time at which the plants were picked	Weight of material used for distillation	Yield in essential oil	
			volume	percentage of material used
<i>Rosmarinus officinalis</i> L.	6 a. m.	1 360 gr.	10.3 cc.	0.76
	between 7 and 10 a. m.	1 970	15.0	0.76
	3 p. m.	2 450	21.4	0.87
		<b>5 780 gr.</b>	<b>46.7 cc.</b>	<b>Average 0.80</b>
<i>Laurus nobilis</i> L.	between 5 and 6 a. m.	1 920 gr.	11.0 cc.	0.57
	between 7 and 9 a. m.	3 920	22.3	0.57
	between 3 and 4 p. m.	1 370	6.7	0.49
		<b>7 210 gr.</b>	<b>40.0 cc.</b>	<b>Average 0.55</b>
<i>Hyssopus officinalis</i> L.	between 4 and 6 a. m.	7 200 gr.	20.2 cc.	0.28
	between 7 and 10 a. m.	4 800	15.2	0.31
	between 1 and 4 p. m.	6 490	17.7	0.27
		<b>18 490 gr.</b>	<b>53.1 cc.</b>	<b>Average 0.29</b>
<i>Lavandula Spica</i> D. C.	between 5 and 6 a. m.	2 000 gr.	27.6 cc.	1.38
	7 a. m.	930	10.1	1.09
	between 2 and 4 p. m.	1 850	22.7	1.23
		<b>4 780 gr.</b>	<b>60.4 cc.</b>	<b>Average 1.26</b>
<i>Salvia grandiflora</i> Ettling	4 a. m.	1 540 gr.	9.2 cc.	0.59
	between 7 and 10 a. m.	1 570	5.0	0.32
	betw. noon and 4 p. m.	1 990	10.0	0.50
		<b>5 100 gr.</b>	<b>24.2 cc.</b>	<b>Average 0.47</b>

Considering that the normal content in essential oils is 1.4 to 2 % for *Rosmarinus officinalis*, 0.4 % for *Hyssopus officinalis* and 0.8 % for *Lavandula spica*, it is considered probable that better results would be obtained if the cultivation of these plants were improved, more especially as the estimations were carried out by a primitive method and that the actual yield in essential oils of the plants studied is probably superior to that found.

MR. PIGOULEWSKII determined the chemical composition of the essential oils obtained by MR. VOULE. They were found to differ little from oils of foreign origin, though they showed some peculiar characteristics. Further research on this subject should be carried out.

The methods for cultivating the plants studied are described by MR. ALBRECHT.

551 - Tobacco Growing in Russia (1). — *Статистика производств, облагаемых акцизом* (Statistics of products subject to indirect taxation), No. II, Part 1, pp. 1-25; Part 2, pp. 1-5. Petrograd, 1916.

In Russia, superior kinds of tobacco from Turkish and American seed (the *Nicotiana tabacum* variety), inferior kinds (*N. rustica*), called "makhorta", "bakun", "chvizent", and other tobaccos of local origin are cultivated simultaneously.

Table I shows the state of tobacco-growing in Russia for the ten years 1905-1914.

TABLE I. — Tobacco growing in Russia during the years 1905-1914.

Year	Plantations						Average area of a plantation in hectares (1)	Production in quintals (2)			
	Number			Area in hectares (1)				Best tobaccos	Ordinary tobaccos	Total	Per hect.
	Best tobaccos	Ordinary tobaccos	Total	Best tobaccos	Ordinary tobaccos	Total					
1905.....	—	—	439 403	—	—	76 830	0.17 ha	423 774	547 110	970 884	12.64
1906.....	—	—	396 977	—	—	58 485	0.14	276 055	458 831	734 886	12.64
1907.....	—	—	377 469	—	—	66 496	0.17	306 376	719 881	1 026 257	15.43
1908.....	—	—	341 966	—	—	68 821	0.20	329 209	614 000	943 209	14.30
1909.....	45 770	292 778	338 548	35 990	29 811	65 801	0.20	342 324	598 488	940 812	15.60
1910.....	43 623	263 671	307 294	42 435	30 565	73 000	0.24	426 386	458 114	884 500	12.12
1911.....	46 200	319 434	365 634	37 502	43 533	81 035	0.22	397 735	866 298	1 264 033	15.60
1912.....	39 385	278 219	317 604	31 272	40 610	71 882	0.23	300 731	906 679	1 207 410	16.80
1913.....	35 107	260 302	295 409	29 513	32 903	62 416	0.21	301 113	757 772	1 058 885	16.96
1914.....	43 023	238 397	281 397	43 227	31 438	74 665	0.26	419 530	600 173	1 019 703	13.66

(1) 1 hect. = 2.471 acres.

(2) 1 quintal = 220 lbs.

(1) See also B., April, 1917, No. 314.

(Ed.)

TABLE II. — *Tobacco growing in Russia during the year 1914.*

District	Number of towns and districts where the tobacco is grown	Number of plantations	Total area in hectares	Production in quintals			Average production in quintals per hectare (1)
				Best tobaccos	Ordinary tobaccos	Total	
Eastern . . . . .	53	6 724	1 808	8 572	4 426	12 998	7.19
Central industrial . .	4	17	3	—	—	31	10.33
Central agricultural .	1 102	57 269	13 034	1 010	264 579	265 589	20.38
Little Russia . . . .	1 600	89 690	17 180	15 820	307 721	323 541	18.83
North Western . . . .	1	12	0.5	5	—	5	10
South Western. . . . .	2 688	68 105	360	594	3 207	3 801	10.56
Southern . . . . .	549	17 720	23 217	255 564	179	255 744	11.02
Transcaucasian . . . .	994	22 653	18 175	137 236	3 697	140 933	7.75
Eastern Siberia . . . .	151	7 640	164	41	5 935	5 976	36.44
Western Siberia . . . .	114	3 858	359	8 035	—	8 035	22.38
Amour . . . . .	190	7 700	276	2 304	—	2 304	8.35
Turkestan. . . . .	3	9	82	4 426	54	4 480	5.46

(1) 1 quintal per hectare = 0.796 cwt. per acre.

The number of plantations varied during the last 10 years and showed a tendency to decrease; in 1905 they numbered 439 403; in 1914, 281 397 — a decrease of 158 006, or 36 %; in 1914, they numbered 14 012, about 5 % less than in 1913. The area under tobacco during these last 10 years has also decreased, but only by 3 %, that is to say from 76 830 to 74 665 hectares. In 1914 there was a great increase in the area as compared with that of 1913, i. e., 12 249 hectares, or 20 %.

During the last 6 years the plantations and area on which tobacco is grown may be divided into 2 categories, superior and inferior.

Table I shows that the superior tobaccos are grown only in the minority of the plantations ( $\frac{1}{5}$  to  $\frac{1}{7}$ ). The area given up to the best tobacco in 1909, 1910 and 1914 exceeded that given up to ordinary tobaccos, whereas the position was reversed in 1911, 1912 and 1913.

The average area of the plantations increased almost continuously from 1905, and in 1910 was 0.24 hectare. During the following years, including 1913, it decreased to 0.21 hectare, or about 14 %. In 1914, the average area of the plantations exceeded that of 1913 by 0.055 hectare.

In Russia ordinary tobaccos are mostly grown. In 1914 their production decreased, as compared with that of 1913, by about 21 %, whereas that of the best tobaccos increased by 39 %.

On the whole, the 1914 harvest was inferior to that of 1913 by 4 %. The unit production of tobacco varied during the ten-year period 1905 to 1914;



in 1913 it reached its maximum value, in 1914 it decreased to 14.9 quintals per hectare, or about 12 % less than the preceding year.

The present state of tobacco growing in Russia is shown in Table II, which refers to 1914. In this table, Russia has been divided into the following districts:

- 1) Eastern district (Samara province)
- 2) Central industrial district (provinces of Nijni-Novgorod and Smolensk)
- 3) Central agricultural district (provinces of Voroneje, Koursk, Orel, Penza, Riazan, Saratov, Simbirsk, Zambov and Toula) and Little Russia (provinces of Poltava, Kharkov and Tchernigov)
- 4) North-western district (Grodno province)
- 5) South-western district (provinces of Volhynie, Kiev and Podolia)
- 6) Southern district.

From Table II it may be seen that the best tobaccos are cultivated chiefly in the transcaucasian and southern districts, whereas ordinary tobaccos are grown in Little Russia and the central agricultural districts.

552 - **Experiments on the Spacing of Tobacco Plants, in Java.** — DE VRIES, O. and SREDENIUS, E., in *Mededeelingen van het Proefstation voor Vorstenlandsche Tabak*, No. XXVII. Semarang, 1916.

This paper contains a detailed description of experiments carried out since 1912 at the Tobacco Experimental Station in Java in order to solve the following problems:

- 1) How is the yield, per plant and per surface unit, affected by the spacing of plants in different soils and climates?
- 2) What effect has the spacing of the plants on the size of the leaves and on their quality and colour?

The following conclusions were drawn from the results obtained:

Yield is perceptibly diminished by close spacing, both in fertile soils and in those less fertile than the average. A spacing of  $3 \times 1.5$  feet is considered best suited to tobacco plantations under the normal soil and climatic conditions of Central Java. With this spacing the size of the leaves, all other conditions being equal, is relatively larger than with closer spacing.

So far as the quality of the leaves is concerned, decreased spacing makes them lighter and more uniform. All the experiments showed a marked improvement on this point.

553 - **The Relation between the Proportion of Veins and of Fruit to the Leaves in Different Varieties of Mulberry.** — See No. 573 of this *Bulletin*.

554 - **Experiments on the Pollination of Fruit Trees.** — CORRIE, LESLIE GORDON, in *The Journal of Heredity*, Vol. VII, No. 8, pp. 365-369, 1 fig. Washington, D. C., 1916.

Experiments have been carried out chiefly on pot trees at the John Innes Horticultural Institution, Surrey, England, to determine which varieties of the different fruit trees are self-fertile and which self-sterile. The trees were grown in a house where they were strictly isolated from insects. Some of the commoner plums, cherries and apples can be classified as follows:

Plums

*Self fertile*

Denniston's Superb  
Early Mirabelle  
Reine Claude Violette  
Myrobalan (red)  
La Prune Géante  
Monarch  
Early Transparent  
Reine Claude Bavay  
Prince Englebert  
Early Favourite  
Gisborne's  
Oullin's Golden Gage  
Golden Transparent  
Victoria  
Czar  
Pershore  
Magnum Bonum (red)  
Magnum Bonum (white)  
Kentish  
Warwickshire Drooper  
Damson var's

*Self-Fertile*

Morello  
Late Duke

*Self-Fertile*

Stirling Castle  
Baldwin  
Washington

*Parthenocarpic:*

Lord Derby  
Duchess of Oldenburg

PLUMS.

*Self-sterile*

Coe's Golden Drop  
Coe's Violet  
Wyedale  
Grand Duke  
Jefferson  
Reine Claude d'Althan  
Pond's Seedling  
Washington  
Early Greengage  
Old Greengage  
Ickworth Imperatrice  
Late Transparent  
Curlew  
Prune d'Agen  
River's Early Prolific } set only about  
Stint . . . . . } 1 %  
Mallard . . . . . } when selfed

CHERRIES.

*Self-Sterile*

Black Heart  
White Heart  
Elton  
Kentish  
Big Frogmore Early  
Big Gaboulay  
Early Rivers  
Guigne d'Annonay  
Black Tartarian

APPLES.

*Self-Sterile*

Northern Greening  
Lord Hindlip  
Cox's Orange Pippin  
Bramley's Seedling

On the whole the self-fertile varieties correspond with the best croppers; this, however, though general, is not always the case, for Rivers' Early Prolific, which is usually a great cropper, is from a practical view self-sterile, setting only about 1 % of its flowers when self-pollinated. May Duke cherry behaves in a similar manner. Some varieties of plums are probably better pollenisers for certain varieties than others, so care should be exercised in selecting the variety best adapted. For instance, when Old Greengage and the Early Greengage are crossed together only about

8% of their flowers develop; whereas, by crossing Greengage with Victoria, excellent results are obtained.

Coe's Violet, Coe's Golden Drop and Jefferson crossed among themselves produce no fruit; crossed with others varieties they produce well.

These phenomena are still more frequent in the apple: Cox's Orange only gives good crops when fertilised by pollen from Stirling Castle, Beauty of Bath and Duchess Favourite. Similar facts are observed among cherry trees.

From almost complete incompatibility there occur gradually increasing degrees of affinity with correspondingly greater crops.

The study of this affinity or physiological classification of varieties should be capable of serving as a guide to the choice of the most suitable varieties.

555 - **The Walnut Tree and the Pecan Nut Tree.** — TRABUT, L., in *Le Progrès agricole et viticole*, Year 34, No. 13, pp. 297-303, 6 fig. Montpellier, April 1, 1917.

In the last few years the value of walnut wood has increased from £ 3.0.0 or £ 4.10.0 per cubic yard to £ 9.0.0 or £ 10.10.0. As a result of this rise in price many owners of walnuts have felled their trees in large numbers, so that, in certain districts, there is a considerable decrease. Nevertheless, under suitable conditions, the walnut tree is a profitable investment, even from a point of view of its fruit only. Strong measures should be taken in the different countries to protect these trees, and Switzerland has already shown the way in this respect.

The author proposes that, in the south of France and similar districts, attempts should be made to grow an American tree of the *Juglans* species whose value, during the last few years, has become equal to that of the walnut. This is the pecan nut tree (*Hicoria pecan* Brit = *Carya olivaeformis* Nutt = *Carya pecan* Engler and Graeb.). This tree grows wild in the following North American States: — Texas, Oklahoma, Louisiana, Mississippi, Alabama, Arkansas, Missouri, Kansas, Tennessee, Kentucky, Indiana, Illinois, Nebraska and Iowa. It has recently been much cultivated in Florida, Virginia, Georgia, Carolina and on the Pacific coast in California and Oregon, and even in the more northern states, Ohio, Michigan, New York, Pennsylvania, Maryland, Delaware and New Jersey.

A century has not yet passed since the Americans began to gather wild pecan nuts, to distinguish between the better and the worse varieties and to graft. It is especially since 1900 that pecan nut plantations have increased. In America these trees suffer from certain fungous diseases and from the attacks of insects which do not exist in Europe, a fact which favours their introduction.

The pecan nut tree is distributed over a very large area, and grows in soils and climates differing greatly one from the other. It grows best in the alluvium of the Mississippi, where it attains a height of 130 feet and a circumference of 19 ½ feet. Its wood is much in demand, and, from 1905 to 1910, the price rose from 2d. to 7d. per pound.

The pecan nut tree was introduced into Europe a century and a half ago, but has not been propagated. Some isolated pecans are almost sterile;



they are not dioecious, but are incapable of self-fertilisation. It is only since the last 15 years or so that the Botanical Department has introduced into France the principal large fruit American varieties and cultivated them. The results have been decisive, and the author does not hesitate to recommend the growing of the pecan nut on the same ground as the growing of the walnut, which it should replace in southern countries where the walnut suffers from the summer heat.

Although it prefers deep, permeable, fertile soils, where its deep roots may be in touch with the water-bearing stratum, the pecan nut appears to adapt itself easily to various soils and climates. It may be sown on the spot, but is best grown in a nursery. Seeds should be taken as much as possible from vigorous trees which are known to be acclimatised. The nuts should be laid out in layers, or, two days before sowing, placed in a shallow vessel full of water and exposed to the sun. The soil should be light, and sandy rather than loamy. During the first year the young plants develop roots 4 or 5 times as long as the stem.

Grafting is now general in all American nurseries. All the different methods of grafting have been adopted successfully, but shield budding is most used as it is the easiest. Dull, rainy days are best for grafting. Under favourable conditions trees sown in February or March may give suitable subjects for grafting in the following spring. These trees must be transplanted the following year. The nursery can then supply subjects of from 3 to 4 years for planting out; older subjects are difficult to transplant. Planting is usually carried out in January or February. Great precautions must be taken that the roots, which should be 20 inches long, do not dry up during transport. The subjects should be left in water for a night before being planted. The hole should be deep (6 ft.) The lower part may be filled with fertiliser, covered with good soil, on the top of which the young tree is placed. Care should be taken that the tree be not planted at a greater depth than it occupied in the nursery. It should be watered before the hole is filled up. It is advisable to fertilise the plantation with green manure. From 8 to 12 years are required before any harvest is obtained.

When ripe the husk opens out into four and the nut falls, or is easily picked. The harvest is gathered in the same way as that of walnuts. The nuts should be placed for about 10 days in shallow layers in a well-ventilated loft, and dried; they are then ready for delivery.

It is necessary to clean nuts that fall and lie on the ground. This is done by means of a cylinder in which they are revolved and polished. Before selling, the fruit should also be sorted as the larger nuts always command a higher price.

The pecan nut greatly resembles the walnut. It is more oily, has a more delicate taste, and does not turn rancid when kept. Its thin shell is very fragile, especially in the improved varieties.

The high prices obtained by pecan nuts have encouraged horticulturists to cultivate them, and, at present, there are over 100 varieties grown in different climates. The most interesting of these are: Cordier, Curtis,

Frotscher, Indiana, Major, Mammoth, Mantura, Money Maker, Moore, Schley, Sovereign, Stuart, Succès, and van Demen. Many hybrids have been obtained by crossing *Carya olivaeformis* Nutt. with the species *Carya aquatica* Nutt. and *C. laciniosa* Loud. (= *C. sulcata* Nutt.).

556 - **The Formation of National Parks in Spain.** — I. Ley creando los Parques Nacionales, in the *Revista de Montes*, Year XLI, No. 959, p. 27. Madrid, January 1, 1917. — II. Los Parques Nacionales, in *España Forestal*, Year III, No. 22, pp. 29-31. Madrid, February 1917.

FORESTRY

Under date December 8, 1916, the King of Spain has sanctioned the following law concerning the formation of National Parks (I):

*Art. 1.* — National Parks are formed in Spain.

*Art. 2.* — Under this law all those districts of the national territory shall be known as National Parks which are exceptionally picturesque, wooded or wild, and which are declared to be so by the State for the sole purpose of: facilitating access to them by suitable roads of communication; causing the natural beauty of the landscape, the wealth of flora and fauna, the geographical and hydrological peculiarities to be respected by protecting them in the most efficacious manner possible against all acts of destruction, deterioration or disfiguration due to the hand of man.

*Art. 3.* — The Minister of "Fomento" is entrusted with: — 1) the formation of National Parks in agreement with the landowners of the districts in which they are situated; 2) the ordering thereof; 3) the allocation of the necessary grants for the formation and maintenance of the roads of communication.

Later, by the Royal Decree of February 23rd. 1917, the Minister of "Fomento" invited the chief Engineers of the forest districts to present to the Board of Agriculture, Mines and Forests, within 2 months:

1) A report on the most noteworthy sites of their circuit which, by reason of their natural or forest beauty, their wealth of flora and fauna, their geographical and hydrological peculiarities are worthy of special protection (account should also be taken of any circumstances concerning religion, history or legend), so that the advisability of declaring them to be *National Parks* or *National Sites* may be considered.

2) A report on the natural peculiarities and curiosities which, independently of the surrounding sites, appear, in themselves, to be worthy of special protection.

3) A report on the most remarkable trees, with special reference to those which, by reason of their size, age, rareness, or the traditions attached to them, have become objects of public veneration.

The same Decree also makes the provisions necessary for the formation of a *Central Board of National Parks* ("Junta Central de Parques Nacionales"), composed of:

1 President (the Director of Agriculture), 1 Vice-President (the Councillor appointed by the Government to the post of *General Commissioner of National Parks*), 2 Senators, 2 Deputies, 1 Professor of Natural Sciences of the Central University, 1 Inspector or Chief Engineer of Forests, and *per se* the Royal Commissioner of Touring.

(1) See: "Un nuevo servicio forestal" and "Discusión del proyecto de ley sobre Parques Nacionales", in the *Revista de Montes*, Year XLI, No. 959, pp. 1-3, 19-25. Madrid, 1917. — "Parques Nacionales", in *Iberica*, Year VII, No. 173, p. 258. Madrid, 1917. (Ed.)



- 557 - **The Native Trees of São Paulo, Brazil.** — NAVARRO DE ANDRADE, E. (Chief of the State Forestry Service and of the "Companhia Paulista de Estradas de Ferro") and VECCHI, O. (Assistant of the Forestry Service of the above-mentioned "Companhia"), *The native woods of São Paulo; Contribution to the study of the forest flora of the State of S. Paulo, Brazil*, V + 376 pp. + figs. S. Paulo, 1916.

The following details of 157 native trees of the State of San Paulo are given: botanical classification (family and species), common names, distribution, distinctive characteristics of the plant and the wood, specific weight of the wood, products and their use. Figures of the plants or their parts are given.

There are also included figures of parts of 66 other trees which are as yet unidentified.

An appendix gives tables of the specific weight, the resistance to breaking, and flexibility of the woods of many of the trees described.

A bibliography of 10 works is included.

- 558 - **The Forests of Porto Rico, Past, Present and Future.** — MURPHY, I. S., in *United States Department of Agriculture, Bulletin No. 354* (Contribution from the Forest Service) 99 pp. + 7 fig. + XII Plates + 1 Map. Washington D. C., 1916.

The island of Porto Rico is very sparsely wooded. The insular and geographical position of the country, its small size, its restricted area of level lands, and its density of population, have occasioned unusual demands on the forests. The same cycle of change is found here as is recorded by civilisation everywhere — the waste and despoliation of the bounties of nature, followed by an acute need for what has been destroyed.

Of the once extensive virgin tropical forest there now remain only isolated remnants in the most mountainous and wind-swept parts of the island. This tract has an aggregate acreage of between 35 000 and 40 000 acres and includes several thousand acres of brushwood. The total area of high forest is scarcely 2 per cent. of the total land area. Part of these forests belongs to the Government. There are, besides, about 400 000 acres classified as "timber and brush lands" and a few thousand acres of mangrove swamps. The total wooded area amounts to approximately 20 per cent. of the total area of the country; but not more than  $\frac{2}{5}$  of this area is now under forest capable of yielding a wood-product other than charcoal and fuel wood. If now there be added the 168 000 acres in coffee plantations and the 6 500 acres under coconut palms, the total of all lands under forest or brush cover will amount to 27 per cent. of the island.

The following forest formations may be distinguished: the littoral woodlands, presenting 2 types, the mangrove swamps and the dry tidal woodlands — the moist, deciduous forests — the tropical rain forests — the dry, deciduous forests — the old field growth — the plantations of coconut, coffee and cacao. In Porto Rico, the climate and hydrological effects of the forests are not very noticeable. The production of lumber and timber is very limited and much must be imported, especially from the United States. The principal forest industry in Porto Rico is charcoal burning. *Bixia Orellana* is grown and supplies a colouring matter;



other colouring and dyeing materials, gums, resins, fibres and fruits produced in the forests would be of decided commercial value if systematically improved.

Reforestation is necessary for the regulation of the water supply and also to provide timber and especially wood for fuel; but in addition, there is great need for scientific knowledge regarding the forestry conditions of the country, systematic management of the existing forest, and improved popular education. Thus an efficient and well-equipped forest administration is required and an energetic forest policy.

The ancient Spanish laws dealing with tree-planting should be enforced and the Board of Commission of Agriculture should have its designation and powers extended to include the subject of forestry. There is in the Sierra of Luquillo, a Forest Reserve (now National Forest which originally formed part of the Spanish Crown lands and after became the property of the Federal Government of the United States. Originally it occupied some 40 000 acres, but is now reduced to 15 000 acres.

An appendix drawn up by Mr. W. D. BRUSH with the assistance of the writer and Mr. C. D. MELL, gives a description of the forest trees of Porto Rico, divided into 172 genera and 57 families.

A second appendix contains a bibliographical index of 100 publications.

559 - **The Forests of the Hawaiian Islands.** — MACCAUGHEY, V., in *The Plant World*, Vol. 20, No. 6., pp. 162-166, 2 fig. Baltimore, Md., June 1916.

The flora of the Hawaiian Islands is noted for its endemic character, which is especially noticeable in the forests. The latter present different types which are dependent upon 2 fundamental factors; elevation and the trade winds. Utilising these two basic factors, the following well-defined types may be distinguished.

- I *Littoral forests*: a) humid (windward); b) arid (leeward).
- II *Lowland forests* (altitude 1 000 to 1 500 ft.): a) humid (windward); b) arid (leeward).
- III *Lower Forest Zone* (1 000 to 2 000 ft.): a) humid; b) arid.
- IV *Middle Forest Zone* (1 800 to 5 000 ft.): a) humid; b) arid.
- V *Upper Forest Zone* (5 000 to 10 000 ft.).
- VI *Bog Zone Forests* (peaks rising into the cloud belt).

Each of these zones and sections is inhabited by representative trees and shrubs which in many instances occur in no other region. Thus *Calophyllum Inophyllum* Linn. (the "kamani") is distinctive of the humid littoral; *Santalum Freycinetianum* Gaud. var. *littorale* Hillb. ("beach sandalwood") of the arid littoral; *Hibiscus tiliaceus* Linn. ("hau") of the humid lowlands; *Erythrina monosperma* Gaud. ("wili-wili") of the arid lowlands; *Aleuritis moluccana* (L.) Willd ("kukui") of the lower forest; *Metrosideros polymorpha* Gaud. ("lehua ohia"); and *Acacia Koa* Gray ("koa") of the middle forest; and *Sophora chrysophylla* Seem ("mamani") of the upper forest.

From the point of view of lumber supply, the only forests of value are those of *Metrosideros polymorpha* and *Acacia Roa*. *Metrosideros polymorpha* attains a height of 75 to 100 ft., the wood is dark red, close grained,

hard and very durable. It is chiefly used for flooring, railroad ties, paving blocks and other purposes that require hardness and durability, and is for many purposes superior to the best oak.

*Acacia Koa*, or "Hawaiian mahogany" is a beautiful golden-red wood prized for fine cabinet work, furniture and interior finishing.

*Aleurites moluccana* is a conspicuous and abundant tree in the lower forests, but its wood is of little value. The nuts (candle nuts) yield an excellent "wood oil" (1), but the expense of gathering the crop has retarded commercial exploitation, *Prosopis juliflora* ("mesquite" or "kiawe") has been introduced into the lowlands; its pods are used as a cattle feed and its wood for fuel.

The chief value, however, of the native forest is as a watershed, protecting the steep mountain slopes and ridges from erosion by the torrential rains and conserving the water supply. Large areas are now included in the Government forest reserves, under the control of the territorial Bureau of Agriculture and Forestry of Hawaii. These reserves are being enlarged from year to year. The fencing of reserves to keep out cattle, the enforcement of trespass laws, the extermination of the highly destructive wild goats and cattle, are prominent features in the preservation of the forests of Hawaii. These native forests are unusually susceptible to injury and deterioration and there are few places in the world where the imperative necessity of forest conservation is as strikingly demonstrated as in the wooded mountains of the Hawaiian Islands.

## LIVE STOCK AND BREEDING.

### HYGIENE

560 - **The Treatment of Overworked Horses and the Value of the Use of Glucose Serum in Intratracheal Injections.**—MASOTTO, LEOPOLDO, in *Il Nuovo Ercolani, Rivista di Medicina Veterinaria*, Year XXII, No. 7, pp. 109-113; No. 8, pp. 125-130. Turin, April 15 and 30, 1917.

The value of intratracheal injections of glucose serum on overworked horses was compared with that of a specially good ration, including green fodder, given to army horses of the same age and breed, and with characteristics as similar as possible. The horses of Group I were given a daily ration of 11 lbs. of oats and 11 lbs. of hay, fed at 3 different times, and every other day they were given an intratracheal injection of 1500 gr. of a 1% glucose serum. The horses of group II received a daily ration of 5 lbs. of oats (cooked during the first week), 15 lbs. of hay, 4 lbs. of dried sugar beet pulp, 3 lbs. of cake. This ration was fed in 5 lots per day.

The treatment lasted 30 days, and the results are summarised in the appended table.

(1) Common "wood oil" which has many technical uses, is the oil obtained from the decorticated nuts of *Aleurites cordata* Stend, grown chiefly in China and Japan. (Ed.)

*Comparison between the glucose serum treatment and the special ration for overworked horses.*

Breed	Weight at the beginning of the experiment lbs.	Weight after 15 days lbs.	Weight after 30 days lbs.	Increase in weight lbs.	State of nutrition
<i>Horses subjected to special ration.</i>					
Italian . . . . .	702	720	748	46	} good
American . . . . .	766	780	802	36	
Norman . . . . .	744	764	794	50	
Breton . . . . .	980	982	1016	56	
<i>Horses subjected to glucose serum injection.</i>					
Italian . . . . .	682	706	722	40	} medium
American . . . . .	784	802	814	30	
Norman . . . . .	754	778	794	40	
Breton . . . . .	998	1026	1044	46	

The results show that, as a general rule, from a practical and economical point of view, good rations are better for recuperative treatment than intratracheal injections of glucose serum, more especially so, as this requires the services of an expert, much time and a certain expenditure. Injections are not recommended in cases of complete prostration and loss of appetite. In other cases the sugar should be administered through the gastric tube, or, still better, both treatments should be carried out in conjunction. By this method two or three intratracheal injections should be given at the beginning. These reanimate the exhausted animal by exciting its appetite. It should then be given a recuperative ration rich in carbohydrates and, if possible, green fodder, so distributed as to give the necessary time for the utilisation of the maximum of the nutritive elements contained in the ration.

561 - **Treatment of Lymphangitis in Horses by Bacteriotherapy.** — TRUCHE, C., in *Comptes rendus des Séances de l'Académie des Sciences*, Vol. 164, 1st. Half-Year, No. 12, pp. 497-499. Paris, March 19, 1917.

Owing to the serious trouble that lymphangitis threatened to cause among cavalry horses in France, a thorough study was made of this type of disease and important results obtained.

Two chief forms of lymphangitis are known at the present day: *epizootic lymphangitis* and *ulcerative lymphangitis*. The former, introduced into France by horses from North Africa, is almost a novelty to veterinary surgeons. The latter is well known and attacks all domestic animals;



the work of PREISZ and of NOCARD who discovered the bacillus simultaneously, is well known.

The PREISZ-NOCARD bacillus is morphologically similar to that of diphtheria. It produces a toxin, gives a film in MARTIN's broth and its favourite medium is coagulated serum. However, after a few transferences, it can give fine cultures on gelose-potato.

While studying the properties of the bacilli killed by an alcohol-ether mixture it occurred to the writer to test their bacteriotherapeutic action upon ulcerative lymphangitis. The results obtained were most encouraging.

ROUX dishes are inoculated with bacilli grown upon coagulated serum. The resulting crop upon the gelose-potato of the dishes is emulsified, after 24 hours incubation at 37° C., in a physiological salt solution.

The emulsion is then centrifugated and the germs killed by adding equal portions of alcohol and ether.

The liquid is left in this way for a night, decanted and either stove or vacuum dried. A large store of germs is thus obtained and the vaccine can be prepared as wanted. All that is required is to emulsify the powder obtained with the physiological salt solution, warm for 2 minutes at 100° C and inject beneath the skin of the neck or shoulders.

The animal stands the injection well; the temperature reaction is weak, 0.5° to 1° C.; the general reaction is nil, there is no loss of appetite and all the other functions remain normal. A small œdema forms at the point of inoculation and disappears at the end of one or two days. The number of injections required varies according to the seriousness and duration of the disease: usually 2 or 3 are sufficient, sometimes a 4th. injection is useful but this is not often the case.

Local attention should be given; washing with antiseptic or painting with tincture of iodine.

After the 1st. injection, towards the 4th. day, the ulcers begin to dry up and the tendons relax. After the 2nd. and 3rd. inoculations, the improvement is obvious, the limb regains its mobility and the skin becomes normal.

Contrary to what is the case with the usual treatment, no relapse has been remarked in animals cured (in one case a year has passed since inoculation) by this method. Further not a single case of elephantiasis of the limb has been observed. The animals treated and cured by the writer are now employed as cab-horses and in spite of their hard treatment show no trace of their old trouble.

562 - **Experimental Work upon Equine Trypanosomiasis in Morocco.** — VELU, H., in *Bulletin de la Société de Pathologie Exotique*, Vol. X, No. 3, pp. 253-260. Paris, May 14, 1917.

The work under notice was carried out at the Research Laboratory of the Stock-raising Department at Casablanca, Morocco.

MESSRS. SERGENT, L'HÉRITIER and BELLEVAL (*Bulletin de la Société de Pathologie Exotique*, Vol. VIII, p. 433, July 21, 1915) have identified *Trypanosoma maroccanum* n. sp. as being the causal agent of an epizooty

among horses which is very common in Morocco and has a clinical aspect of quite a special character.

The writer, who has already drawn attention to this disease (*Ibid*, 1915, p. 115 and p. 646) has carried out experiments upon the behaviour of this trypanosome in several different animal species (mules, dogs, rabbits, rats, sheep, goats). For purposes of inoculation, parasites were used from 6 different horses.

The results were as follows:

The trypanosome was shown to be very virulent for the white rat which, after an incubation period of 3 or 4 days, showed acute infection lasting over an average period of 7 to 10 days. Autopsy showed the spleen to be enormously enlarged.

The rabbit is apparently little affected. The disease assumes a chronic aspect and develops slowly and irregularly. Symptoms and lesions are the same as those produced by the other trypanosomes in these animals.

Following inoculation, the dog showed infection of the sub-acute type with frequent bouts of fever. The almost constant presence of the trypanosome in the blood of the animals makes the course of the illness easy to follow.

In the case of 2 mules, the disease ran a much more rapid course than that in the horse resulting from natural infection; the period was 68 to 98 days. The incubation period after intravenous inoculation was 9 and 5 days. Passage through the rat seems to have increased the virulence for the mule. No oedemas were noticed.

Two goats and two sheep inoculated never showed any trypanosomes in the peripheral circulation nor any symptoms other than attacks of fever and loss of weight. The 2 goats recovered, one after 13, the other after 12 months.

**563 - Tuberculosis of the Goat.** — MOUSSU, M., in *Comptes rendus des Séances de l'Académie d'Agriculture de France*, Vol. III, No. 12, pp. 341-348. Paris, March 28, 1917.

Although tubercular lesions of any kind are rarely found in slaughtered goats, the general opinion that these animals are never attacked by tuberculosis is quite erroneous.

The question of tuberculosis in the goat is of great interest, not only from a scientific point of view, but also from that of public health. The goat is often called "the poor man's cow", and is much used in the vicinity of towns, and especially round Paris, for the artificial feeding of infants, and many families of the working-class keep goats under fairly precarious conditions.

There is no doubt that tuberculosis is rarely found in goats, that the clinical symptoms may often be confused with those of other diseases, more particularly venomous bronchial-pneumonia, and that the disease is unsuspected during life and recognised only after death. It should also not be confused with parasitic pseudo-tuberculosis frequent among small rodents.

There is absolutely no doubt that goats are susceptible to tuberculosis. From an experimental point of view goats may easily be infected



with bovine tuberculosis by intravenous inoculation. They may also contract it by living for a prolonged period amongst cows. This was conclusively proved by experiments in which young goats from a small herd, and sheep, were left to wander at liberty about a stable in which tubercular cows were housed. An average period of 1 year of stable contamination was necessary for the goats to develop the disease, whereas the cattle contracted it in a few weeks or a few months and the sheep only after 2 years. Once the herd of goats was infected, the other animals were contaminated in a relatively short time.

It seems that the tubercle bacillus only establishes itself with difficulty in the goat during the 1st. period of acclimation, but once this period is past, the contagion spreads fairly rapidly.

Natural tuberculosis was observed in a herd of 16 goats in the eastern suburb of Paris. During the year 1916 three of these goats died and the *post mortem* examination of one of them (made by the veterinary surgeon, M. GUÉNIOT) showed tuberculosis to be the cause of death. The 11 surviving animals were then subjected to the intrapalpebral tuberculin test; 6 gave a positive reaction; the 5 youngest did not react. Here, therefore, was a herd attacked naturally by tuberculosis of unknown origin. The animals were used for the production of milk, and more than half of them were diseased.

It has been proved experimentally that, if goats contract bovine tuberculosis, they only contract human tuberculosis with great difficulty. There is a marked difference between the human and bovine bacilli, but it is only a question of acclimation and the author has been able to bring about the passage of the one species to the other.

The author concludes that insufficient attention is paid to the question of milk used as food for children and old people. Even in the case of goats the sanitary condition of the animal supplying the milk should be controlled, above all from the point of view of tuberculosis.

**564 - The Nutrients Required to Develop the Bovine Foetus.** — ECKLES, C. H. in *University of Missouri College of Agriculture, Agricultural Experiment Station, Research Bulletin* 26, pp. 1-36. 23 plates + 4 diagrams. Columbia, Missouri, November 1916.

Under ordinary conditions the cow uses food for one or more of five purposes. These are: 1) maintenance, 2) milk production, 3) gain in body weight; 4) growth, 5) development of the foetus. Experimental data are available regarding the nutrients required for each of the first four. Feeding standards have been calculated from these data and are generally considered sufficiently accurate to be of practical use. No experimental data have been found concerning the nutrients required for the last, the development of the foetus, although some results have been published of experimental work closely related.

This investigation carried out by the writer is an attempt to determine the nutrients required to develop the bovine foetus.

At the close of an investigation carried out to determine the cause of wide variation in milk production by dairy cows, two cows were available and the necessary data partly taken to make this study possible.



These cows had been kept farrow and the maintenance requirements determined for a period of 180 days for one, and for 150 days for the second. During the maintenance period both received the same ration except as it was necessary to vary the quantity on account of the difference in size of the two animals. A digestion trial was conducted for each during this maintenance period. It was then planned to breed these cows and continue them on exactly the same ration, both in kind and quantity, during gestation. The effect of gestation would then be measured upon the cow herself rather than in terms of feed, taking into consideration the weight and condition of the cow after parturition. At a later date three more cows were available which had received precisely the same treatment as the two first mentioned, their maintenance requirements having been determined for a period of six months. A digestion trial had also been carried out for each during this maintenance period. It was planned to breed two of these cows, using the third one as a check, the rations being kept in the same proportion as had been found necessary during the maintenance period. By following this plan of using a check animal, any variation that might be due to the influence of the season of the year or quality of feed would be controlled by the check animal. The results were to be measured as in the first experiment by the effect upon the cow rather than by the amount of feed consumed.

After the results of the first experiment were available the original plans of the investigation were enlarged and the cooperation of the department of agricultural chemistry of the Missouri Experiment Station was secured for the purpose of taking data in regard to the composition of the foetus at birth. A portion of the results of these analyses have been published (1) and the remainder will be made public at a later date.

The results of these two investigations presented in this Bulletin in 23 Tables and 4 Diagrams, and amply discussed by the writer lead to the conclusion that the amount of nutrients necessary to develop the bovine foetus is so small that it cannot be measured by ordinary methods of experimentation.

In fact, the cows developed calves of normal size for the breed on a maintenance ration only sufficient to maintain them at uniform weight when not pregnant and not producing milk, and one cow weighed forty-eight pounds more after the calf was dropped than when bred and the others weighed only seventeen pounds less.

These results may be due to one or more of three possible factors: 1) better use of feed during gestation; 2) decreased maintenance during pregnancy; and 3) small amount of dry matter in foetus.

The conclusions with reference to these three factors may be summarized as follows:

1). While the data taken are not very satisfactory, the indications are that the coefficient of digestibility is not changed by pregnancy.

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(1) TROWBRIDGE, P. F. Composition of the bovine foetus. *Proceedings of the American Society of Animal Production*: 100-104. 1915.

2). The data do not make it possible to conclude definitely that the maintenance of the animals is decreased by pregnancy, but it is thought this is probable, and could be accounted for by the animal being quieter when in this condition.

3) The data show that the amount of dry matter contained in the foetus and its accompanying fluid and membranes is very small. The small feed requirements necessary to supply the dry matter of the foetus together with the amniotic fluid and placenta, is either too small to be measured on account of the length of time represented or is offset by the saving due to decreased maintenance.

Four Jersey calves analysed at birth contained an average of 73.09 per cent. of water. Data available indicate that breed is not a factor influencing the composition of the new born calves. The amniotic fluid weighs about thirty pounds and contains approximately 95 per cent. of water. The placenta weighs about 18 pounds, of which approximately 85 per cent. is water.

A Jersey cow produces a total of only 15 or 20 and a Holstein 20 or 25 pounds of dry matter in the foetus and its accompanying fluid and membranes.

On the dry matter basis a Jersey calf at birth is equivalent to from 110 to 170 pounds of Jersey milk. In the Holstein breed the calf at birth will contain as much dry matter as from 200 to 275 pounds of Holstein milk.

Using the Jersey cow as typical of all, it is shown that she produced during one year 1263 pounds of dry matter in her milk. During this time 2828 therms of energy were available in her ration for this milk production in excess of maintenance. Her calf, with placenta and amniotic fluid, contained approximately 24 pounds of dry matter or 1.9 per cent. as much dry matter as in her milk for one year.

If the calorific value of the solids in the foetus are considered equivalent pound for pound to that of the solids in the milk, it would appear by calculation that this cow would require 1.9 per cent as much energy as was used for her milk production, or 47.7 therms. The actual energy in the foetus and its accompanying fluid and membranes calculated from the weights and composition was 56.4 therms, a figure surprisingly close to calculated requirement of 47.7 therms.

All the data available indicate that the weight of a calf at birth is not ordinarily influenced by the ration received by the mother during gestation. This is especially true with reference to the energy value of the ration, but may not hold good when the ration has been decidedly deficient in some constituent for a long period.

565 - **New Feeding-Stuffs used in Germany during the War.** — KLING, M. (from the Agricultural Station of the Speyer district), in *Landwirtschaftliches Jahrbuch für Bayern*, Year 6, No. 11-12, pp. 483-513. Munich, 1916.

A large number of feeding-stuffs which have been placed on the market since the war and recommended either as new foods or as substitutes, have been analysed and examined at the Agricultural Station of the Speyer district. This paper deals with the foods received for analysis from the 1st. April to the 1st. October, 1916. The following are the most important :



1) *Rhubarb Leaves*. — Up to the present these leaves have been left in the fields to be dug in as manure; now they are recommended as food for cattle. Their chemical composition is:

Moisture . . . . .	90.02 %	Nitrogen-free extract . .	3.86 %
Crude protein . . . . .	2.78	Crude fibre . . . . .	1.04
Crude fat . . . . .	0.40	Ash (chiefly sand) . . .	1.90

The leaves are very rich in moisture, but their dry matter contains solids of high nutritive value, especially in protein. The dried leaves are said to be better than hay of the first quality and might be fed to pigs. Preference should, however, be given to the green leaves.

2) *Seaweed*. — Both dried and fresh seaweed has been put on the market. The analysis of samples of *Fucus vesiculosus*, both when dried and when fresh, gave the following results:

	Fresh Seaweed	Ground Dry Seaweed
Moisture . . . . .	37.97 %	11.82 %
Crude protein. . . . .	10.52	6.50
Crude fat . . . . .	1.65	3.43
Nitrogen-free extract . . . . .	26.78	41.93
Crude fibre (König's method). . . . .	8.95	20.00
Ash . . . . .	14.13	16.32
	100.00 %	100.00 %

If the solids of these two foods are compared, it is seen that their chemical composition is not quite identical. Fresh seaweed is richer in crude protein than ground dry seaweed but poorer in crude fat and crude fibre. As a rule seaweed contains little protein or fat, but a large quantity of nitrogen free extract and crude fibre.

Experiments made in Norway and France, and, recently, at the "Kaiser Wilhelm Institut" at Dahlem (Berlin), show that this food may well be given to animals. No trace of its smell could be found either in the meat or eggs of experimental animals. It has not yet been determined to what point its nutritive elements are utilised by animals, but its nutritive value appears to depend chiefly on its nitrogen-free extract, which consists principally of lichen starch, arabinose, d-galactose, etc. The crude fibre is probably also easily digested. However this may be, it seems most advisable to give the seaweed in the ground, dry state, as a supplementary food, especially for cattle and pigs. Its nutritive value must not be overrated. Fresh seaweed should not be transported great distances as it is liable to go bad.

3) *Straw Meal*. — This is much used, but is often put on the market under false names. The same meal was analysed under three different names. — "Futtermehl aus Getreideabfällen" (meal made from cereal by-products); Pflanzenfuttermehl F. (vegetable meal F) and "Futtermehl für Jungvieh und Schweine, Sorte 3" (meal for young cattle and pigs, type 3).



In all three cases the samples consisted of ground straw of cereals. The prices were respectively M 38.5, M. 28, and M. 50 per quintal (1).

Feeding experiments carried out with this meal, and its chemical composition, both prove this food to be unsatisfactory for pigs, cattle and horses, and the price out of all proportion to its actual nutritive value. The same may be said of the product called "Erbsenstrohmehl" (Pea-stalk meal), which is also widely distributed on the market.

4) *Spelt Chaff Meal*.— Finely ground spelt chaff is a product sold under a false name and at very high prices. Two samples, under the names of "Futtermehl" (fodder meal) and "Weizenmehlkleie" (wheat-flour bran) respectively, were composed almost entirely of ground spelt chaff and only contained traces of flour. Their value does not exceed that of the whole chaff, and their use is not recommended.

5) *Concentrated Straw Fodder; Concentrated Straw Fodder with Albumen added*.— By boiling straw in an alkaline solution under pressure a concentrated, easily digested food is obtained. Part of the solids, including the crude protein and the greater part of the nitrogen-free extract, is lost, but the crude fibre becomes more digestible and, as compared with the solids, has the same starch value as pure starch.

This process has been introduced into Germany by OEXMANN. The cellulose prepared as above is mixed with molasses and the whole dried. About 30 parts of molasses should be mixed with 70 parts of moist straw. The product, "Strohkraftfutter" (concentrated straw fodder) is highly recommended. Its chemical composition is given below:

Moisture . . . . .	9.30 %
Crude protein . . . . .	3.55
Crude fat . . . . .	0.37
Nitrogen-free extract . . . . .	29.04 (13.7 % of which is sugar)
Crude fibre . . . . .	53.04
Ash . . . . .	4.70

Its starch value is 70 to 75 kg. per quintal. It contains little albumen and its crude protein, consisting of the amides of the molasses, cannot entirely replace this want.

For this reason, matter rich in albumen has been added to this product and the mixture is known under the commercial name of "Eiweissstrohkraftfutter" (concentrated albumen straw fodder). Dried yeast was first added as albuminoid, but now ground lupin seeds freed from their bitter elements are chiefly used. The sale of this product has been taken over by the "Bezugsvereinigung der deutschen Landwirte" (Cooperative Association of German Agriculturists, Berlin), which distributes it to farmers through the agency of the "Landesfuttermittelstellen" (district offices for the distribution of fodder) or the "Kommunalverbände" (parish federations). Analysis showed it to have the following composition:

	Sample I	Sample II
Moisture . . . . .	10.82 %	8.83 %
Crude protein . . . . .	10.75	6.00
Fat . . . . .	0.32	0.25
Nitrogen-free extract . . . . .	44.99	44.62
Crude fibre . . . . .	28.10	34.17
Ash . . . . .	5.02	6.13
	100.00 %	100.00 %

In both samples lupin seeds freed from their bitter elements were added to supply the deficient albumen.

The results of feeding experiments showed that the concentrated straw fodder with albumen added was a suitable food for all animals. It replaces oats for horses, for which it is an excellent food, and is equally suitable for cattle. Good results were also obtained when the ration of pigs was composed of from  $\frac{1}{6}$  to  $\frac{1}{4}$  of this product.

6) *Crushed and Ground Maize Ears*. — A sample of crushed ears ("Maiskolbenschrot") was composed of ears coarsely ground with traces of flour. Their price was 38 Marks per quintal and their composition as follows :

Moisture . . . . .	9.83 %	Nitrogen-free extract .	49.91
Crude protein . . . . .	3.40	Crude fibre . . . . .	34.17
Crude fat . . . . .	0.32	Ash . . . . .	2.37

As its feeding value does not exceed that of wheat chaff, its use is not advised.

7) *Heather Stalks*. — An excellent food may be prepared with the leaves, flowers, seeds and fine stalks of heather, but very woody stalks only have a minimum feeding value. Their composition is :

Moisture . . . . .	9.50 %	Nitrogen-free extract .	45.38 %
Crude protein . . . . .	4.15	Crude fibre . . . . .	35.47
Crude fat . . . . .	3.00	Ash . . . . .	2.50

8) *Kohl-Rabi By-Products*. — Two foodstuffs have been prepared with the peelings and partially putrified roots. The decomposing roots, made into slices and then dried, give a fairly good food (9 to 10% moisture; 9 to 10 % protein; 1 to 5 % fat; 49 to 58 % nitrogen-free extract). The decomposition of the roots must not, however, be too far advanced, neither should the food contain more than 10 % moisture and 1 % of impurities (sand, clay, etc.)

The second food (9 to 16 % of moisture; 10 to 12 % of protein; 0.92 to 1.13 % of crude fat; 41.63 % of nitrogen-free extract) prepared with peelings, contained so high a proportion of sand and other impurities that it could not be used with safety. When buying it great importance must be attached to purity and all goods containing much sand should be refused.

- 9) *Ground Sugar-Beet Seeds*. — Seeds which have lost their germinating power are ground and sold as feeding-stuff. A sample had the following composition :

Crude protein . . . . .	11.63 %
Crude fat . . . . .	4.42
Ash . . . . .	8.96

Apart from a small quantity of mineral impurities, the sample was composed of fairly pure ground sugar beet seeds. The nutritive value of these seeds is about  $\frac{2}{3}$  that of wheat bran and it is particularly well suited to cattle and horses.

- 10) *Parsley Seed*. — A large quantity of unsold parsley-seed was put on the market as food for cattle. Its composition is given below :

Moisture . . . . .	11.50 %	Nitrogen-free extract . .	36.04 %
Crude protein . . . . .	13.75	Crude fibre . . . . .	6.50
Crude fat . . . . .	23.40	Ash . . . . .	8.81

This food should be given to animals that are receiving rations poor in stimulants (potatoes, roots, rain-soaked hay), but the amount should be moderate. The seeds should be crushed and the price low.

- 11) *Wild Radish Husks*. — The husks of the wild radish (*Raphanus Raphanistrum*), which are often found in cereal meals, are eaten by the cattle to whom these meals are given. In a sample of barley meal was found 41 % of these husks with the following composition :

Moisture . . . . .	6.90 %	Nitrogen-free extract . .	43.32 %
Crude protein . . . . .	10.00	Crude fibre . . . . .	30.40
Crude fat . . . . .	6.78	Ash . . . . .	2.60

These husks, whose nutritive value is 40 % that of good barley, may be fed to cattle and to horses, but not to pigs.

- 12) *Roumanian Bran*. — Before Roumania came into the war Germany imported from that country large amounts of bran (wheat and rye). Later farmers frequently complained that, after eating this bran, pigs became ill and even died. Samples of the suspected bran were analysed chemically and microscopically, but not bacteriologically. Their composition was normal and the sickness and death of the pigs do not seem to have been caused by this product.

- 13) *Mixture of Brewers' Grain and Yeast*. — By a special process the dry grains are mixed with the moist yeast, and the whole dried. This product, differing little in appearance from dry brewers' grains, has the following composition :

Moisture . . . . .	7.18 %	Nitrogen-free extract	37.58 %
Crude protein . . . . .	30.80	Crude fibre . . . . .	13.63
Crude fat . . . . .	5.63	Ash . . . . .	5.18



This food contains about 75 % of grain and 25 % of yeast, and is suited more especially to horses and cattle.

14) *Wine yeast*. — The yeast of fresh wine cannot be used as a food until the large quantity of tartar it contains (as much as 25 %) has been removed. This is done by washing and the yeast made into a cake. Its composition is:

Moisture . . . . .	60.33 %	Nitrogen-free extract	3.80 %
Crude protein . . . . .	12.86	Crude fibre . . . . .	14.62
Crude fat . . . . .	5.47	Crude ash . . . . .	2.92

The average amount of 1.65 % of tartaric acid corresponds to 2 % of tartar and may be neutralised by calcium carbonate. As yeast cake soon becomes slimy it should not be kept long. The yeast with which it is prepared should be cooked.

No experiments have yet been made on the digestibility of wine yeast freed from tartar, but it appears to be easily digested. The best results are obtained by feeding it to pigs at the rate of 0.44 lbs. to 1 lb. per head per day. Cattle, particularly dairy cows, eat it readily (3.30 to 4.40 lbs. per head per day). It is less suited to horses.

15) *Ground Grape Pips*. — In Germany the residue of grapes is distilled to extract the alcohol. The pips are either crushed for their oil or ground into a food with the following composition:

Moisture . . . . .	13.40 %	Nitrogen-free extract	35.16 %
Crude protein . . . . .	10.00	Crude fibre . . . . .	29.52
Crude fat . . . . .	7.00	Ash . . . . .	4.92

This food, therefore, is very rich in crude fibre, with a nutritive value closely corresponding to that of medium quality meadow hay. If the pips are ground after the oil has been extracted the food has less value.

16) *Beechnut Cake*. — The analysis of whole ground beechnuts gave the following results:

Moisture . . . . .	16.35 %	Nitrogen-free extract	28.88 %
Crude protein . . . . .	18.50	Crude fibre . . . . .	19.67
Crude fat . . . . .	4.40	Ash . . . . .	11.20 (6.5 % is sodium chloride).

Sodium chloride (cooking salt) had probably been added to make the animals accept better this food which is very rich in tannin. Its starch value is 40 kg. per quintal, and it is well suited to cattle. The price asked, 31 Mark per quintal, is much too high.

17) *Walnut Cake*. — Cattle much appreciate cake made of nuts without their shells. Sometimes the nuts are pressed with their shells, as was the case with nut-cake from Roumania and Bosnia whose composition is given below:

Moisture . . . . .	9.55 %	Nitrogen-free extract	46.29 %
Crude protein . . . . .	9.50	Crude fibre . . . . .	23.70
Crude fat . . . . .	9.00	Ash . . . . .	1.96

The fodder value of this cake is about equal to that of beechnut cake.

18) *Fish Meal*. — Fish meals are rare in Germany now, and their quality has deteriorated. A sample examined contained, besides 41.10 % of protein and 3.33 % of fat, 25.59 % of cooking salt. This high percentage of salt is detrimental to the health of the animals, indeed, it is recently supposed to have been the cause of numerous cases of sickness and death among pigs. Fish meal, such as the above, should only be fed in very small quantities, and no salt ration should be given with it.

19) *Foods for fattening Pigs*. — These food-stuffs are put on the market either by the above-mentioned Cooperative Association of German Agriculturists, or else by private firms.

A food of this description composed chiefly of crushed maize with a little ground maize ears and acorn meal contained 9.84 % of crude protein, 3.36 % of fat and 2.29 % of ash. This may be considered satisfactory.

Another food made with corn bran, crushed corn, barley, oats acorn meal, ground seeds of weeds, seaweed meal and fish meal contained 11.8 % of water, 15.15 % of protein and 5.08 % of ash. This is also recommended.

A 3rd. food composed of seaweed meal, the tegument of coriander fruit, potato pulp, the by-products of preserves, and crushed bones, was of slight value only. Another food consisted of 25 % of crushed bones, 8 % of maize, 5 % of corn bran, 12 % of beetroot slices, and 50 % of vegetable meal (chiefly pea-straw meal). It contained 15.7 % of protein, 3.71 % of fat and 21.33 % of ash. Its use is not advised.

A 5th. food was composed of peanut husks, oat chaff, straw meal, barley chaff, calcium phosphate, crushed seeds of weeds, and spelt chaff. It contained 4.38 % of crude protein and 14.84 % of ash. As its nutritive value is nil, its use is not recommended.

A 6th. meal was made of straw, chaff, dried ground grape residue, bones crushed with a little meat, cooking salt, and impurities. It contained 19 % of crude protein, 22.2 % of nitrogen free extract, 2.99 % of crude fat and 35.08 % of ash. Its use is also not recommended.

20) *Poultry Food*. — All sorts of by-products of little value are now being sold as poultry food. One of these foods, containing 17.5 % of protein, 3.03 % of fat and 40.76 % of ash, was composed of whole seeds of weeds, bad quality cereal seeds, leguminous seeds, beetroot seeds, grape residue, crushed bones, crushed mussel shells and much sand, and was sold at 1.5 *Mark* per kg. Its purchase at that price is not advised.

A 2nd. food made of rye attacked by smut, wood-charcoal and other impurities, caused symptoms of sickness in hens. Its price, 24 *Mark* per quintal, is considered excessive.

A 3rd. food called "Nährsalz Lukrativ" (Lukrativ feeding salt) has the following composition: — silicate powder, 18 %; calcium carbonate, 35 %; sodium chloride, 7 %; magnesium sulphate, 11 %; sodium bicarbonate 8 %; sulphur, 2 %; Glauber salts, 18 %; calcium phosphate in small quantities. The price asked, as much as 0.90 *Mark* per kilo, is too high in proportion to its relatively low nutritive value.

21) *Horse Food*. — Under the name of "Pferdefutter" a food is sold which contains 9.75 % of protein, 1.73 % of fat and 9.67 % of ash. It is made up of corn chaff, dried beetroot slices, vegetable (pea) meal. The price, 36 *Mark* per quintal, is considered too high.

22) *Feeding Meal*. — A feeding meal ("Futtermehl") made at the Nurl Werke, at Strasbourg (Alsace), and sold at 48 *Mark* per quintal, had the following composition :

Moisture . . . . .	9.60 %	Nitrogen-free extract . . . . .	39.22 %
Crude protein . . . . .	7.00	Crude fibre . . . . .	29.28
Crude fat . . . . .	2.73	Ash . . . . .	12.17

A microscopical examination showed the presence of ground spelt chaff, ground grape residue, small quantities of straw meal and 2.5 % of cooking salt. It is, thus, a coarse food for cattle and horses, and its price is excessive.

A food sold under the name of "Pflanzenfuttermehl G" (vegetable fodder meal, G) was composed of seed-beet straw, cereal straw and woody stalks. Its nutritive value does not exceed that of straw meal.

566 - **Experimental Researches on the Nutritive Value of Maize; Raw, Sterilised and Decorticated.** — WEILL, E. and MOURIQUAND, G., in *Comptes Rendus des Séances de la Société de Biologie*, Vol. LXXX, No. 8, pp. 372-375. Paris, April 21, 1917.

The writers have already drawn attention to the disturbances produced in animals (notably pigeons) by a diet of completely sterilised, or decorticated, seed (barley, wheat, rice, the seed of some Leguminosae) (1) and they have found that decortication is equivalent to sterilisation; the latter seems to kill the ferment, or group of ferments, contained in the cuticle, the former removes these substances with the cuticle.

In the article analysed, the writers describe their experiments with maize grain fed to pigeons; the birds received; perfectly raw maize — completely sterilised maize — decorticated maize. The results show:

- 1) The high nutritive value of maize when raw, and not decorticated; it produces quite special vigour in pigeons.
- 2) The destructive action exercised by sterilisation on the ferment contained by the cuticle.
- 3) The possibility of producing paralysis due to malnutrition by complete sterilisation of bread, as well as by decortication of the grain.
- 4) The dystrophic action (in certain cases) of decorticated grain on cutaneous nutrition (pellagra?).

567 - **The Propagation of Wild-Duck Foods.** — MCATEE, W. L., in *United States Department of Agriculture, Bulletin* No. 465, 40 pp., 35 figs. Washington, Feb. 23, 1917.

The Bureau of the Biological Survey of the U. S. Department of Agriculture is constantly requested to give information concerning the propagation of valuable wild-duck foods. The Bureau has endeavoured to meet the demand by issuing the following three publications: 1) *Biological Sur-*



vey, Circular No. 81, Sept. 9, 1911; 2) U. S. Dept. Agr. Bulletin No. 58, Feb. 7, 1914; 3) U. S. Dept. Agr. Bulletin No. 205, May 20, 1915, which deal with the value, nature, habitat, methods of propagation, etc., of 19 groups of plants including more than 60 species.

The Bulletin No. 465 summarised below, consists of a revision of the first 2 publications and gives information as to the food value for wild ducks, description, distribution and propagation, of the following plants :

- Wild rice (*Zizania palustris* and *Zizania aquatica*)
- Wild celery (*Vallisneria spiralis*)
- Pondweeds (*Potamogeton* spp.)
- Arrowheads (*Sagittaria* spp., and especially *S. platyphylla* (delta potato); *S. latifolia* and *S. arifolia* ("wapato").
- Chufa (*Cyperus esculentus*).
- Wild millet (*Echinochloa crus-galli*).
- Waterlily (species of the 3 families *Cabombaceae*, *Nelumbonaceae* and *Nymphaeaceae*, and especially : banana waterlily (*Castalia mexicana*).

Bulletin No. 205 deals with the following plants :

- Musk grasses (*Algae*, *Characeae*)
- Duckweeds (genera *Wolffia*, *Wolffiella*, *Azolla*, *Lemma*, *Spirodela*, etc.)
- Frogbit (*Limnobium spongia*)
- Thalia (*Thalia divaricata* — *T. dealbata* — *T. barbata*)
- Water Elm (*Planera aquatica*)
- Swamp privet (*Forestiera acuminata*)
- Eel grass (*Zostera marina*)
- Widgeon grass (*Ruppia maritima*)
- Water cress (*Sisymbrium Nasturtium-aquaticum*)
- Water weed (*Anacharis canadensis gigantea*)
- Coontail (*Ceratophyllum demersum*)

Many other plants cannot be obtained commercially, either as seeds or as other parts necessary for propagation, but are valuable as food for wild ducks. The following species are indicated by the writer as being the best.

- Burreed (*Sparganium eurycarpum* and *S. angustifolium*)
- Pondweeds (*Potamogeton heterophyllus* — *P. pusillus* — *P. filiformis* — *P. interior*)
- Western widgeon grass (*Ruppia occidentalis*)
- Horned pondweed (*Zannichellia palustris*)
- Bushy pondweed (*Najas flexilis*)
- Arrowhead (*Sagittaria longiloba* — *S. rigida* — *S. teres* — *S. graminea* — *S. papillosa*)
- Grass (*Panicum condensum*)
- Switch grass (*Panicum virgatum*)
- Salt marsh grass (*Spartina cynosuroides*)
- Cord grass (*Spartina Michauxiana* and *S. gracilis*)
- Meadow grass (*Panicularia nervata*)
- Bulrush (*Scirpus americanus* — *S. validus* — *S. occidentalis* — *S. paludosus* — *S. robustus* — *S. fluviatilis* — *S. cubensis*)
- Sawgrass (*Cladium effusum*)
- Sedge (*Carex decomposita*)
- Wampee (*Peltandra virginica*)

Pickereel weed (*Pontederia cordata*)

Smartweed (*Polygonum amphibium* — *P. pennsylvanicum* — *P. opelousanum* — *P. hydropiperoides* — *P. hydropiper* — *P. punctatum* — *P. sagittatum*)

Saltwort (*Salicornia europaea* — *S. ambigua*)

Water primrose (*Jussieuia leptocarpa*)

Water pennywort (*Hydrocotyle umbellata*)

### 568 — Is Lysine the Limiting Amino-acid in the Proteins of Wheat, Maize or Oats? —

MCCOLLUM, E. V., SIMMONDS, N. and FITZ, W., in *The Journal of Biological Chemistry*, Vol. XXVIII, No. 2, pp. 483-499, 12 diagrams + 4 plates. Baltimore, Md., January 1917.

The present paper is from the Laboratory of Agricultural Chemistry of the Wisconsin Experiment Station, Madison.

Data published in 1914 by OSBORNE and MENDEL (*The Journal of Biological Chemistry*, 1914, Vol. XVII, pp. 325 and 334) were interpreted by them as indicating that maintenance, but not growth, of an animal is possible without the amino-acid lysine. This created the impression in the minds of several investigators that this amino-acid is the limiting factor in determining the value of many proteins of vegetable origin.

In the course of their studies directed towards ascertaining the supplementary relationships among the naturally occurring food-stuffs, the writers have obtained data which bear on this subject in a definite way. The results leave no room for doubt that a generalisation cannot safely be made that any one amino-acid, like lysine, is present in the protein mixture in our more common vegetable foods in amount relatively smaller than are other essential amino-acids. Indeed we are forced to the conclusion that in the protein mixture of the maize kernel and the oat kernel, lysine certainly is not the essential protein cleavage product which is present in an amount so small that it is the limiting factor which determines the biological value of the proteins of these seeds.

The rations employed by the writers were made up on the following plan. A food mixture consisted of a single grain so supplemented with organic salts and butter fat as to be properly constituted for promoting growth and prolonged well-being, except that the protein was too low in amount to promote growth at the normal rate. In all cases the rations were shown to be made highly efficient for growth by the addition of purified protein alone, when casein was employed. Casein is well known to be a complete protein, and to suffice as the sole source of nitrogen throughout the life of the rat. (Cf. *Journal of Biological Chemistry* 1915, Vol. XX, p. 415; Vol. XXIII, p. 231).

Rations made up in this way were fed without the addition and also with the addition of the incomplete proteins zein and gelatin respectively. The former yields no lysine while the latter yields about 6 %. Obviously if lysine were the one amino-acid whose addition is necessary in order to improve the protein mixture of the grain employed in the food mixture there should be a response with growth when gelatin is added and no improvement when zein is added.

The results may be summarised as follows :

1) Zein does not supplement the protein mixture in the wheat kernel or the maize kernel so as to improve the rate of growth of young rats.

2) Zein does supplement the proteins of the oat kernel in a surprisingly efficient manner, although it lacks tryptophane and lysine and is one of the poorest in cystine. In the proteins of the oat kernel, therefore, the above amino-acids are eliminated as being possibly the essential protein cleavage products present in minimal amount, and determining the plane of intake essential for growth.

3) Gelatin chemically supplements the protein mixture of both the wheat kernel and oat kernel respectively. Since gelatin contains no tyrosine or tryptophane, and but a trace of cystine, but contains 6 % of lysine, it is evident that neither tyrosine, tryptophane, nor cystine is the limiting amino-acid in these grains. It tends to support the view, but does not prove that lysine is the amino-acid whose addition alone to the wheat protein mixture raises the biological values of the latter.

4) The addition of wheat gluten to either the wheat or maize kernel protein supplements them so as to improve growth. The proteins of the wheat gluten are probably as a mixture qualitatively adequate as respects all of the indispensable amino-acids, although we cannot look upon this point as definitely established. One of its constituents, glutenine, has been shown by OSBORNE and MENDEL to be capable of supporting growth when it furnished 93.2 % and "protein-free milk" 6.8 %.

It seems probable, therefore, that the combinations, used by the writers, of wheat kernel proteins with wheat gluten led to growth because of a higher intake of protein rather than a supplementary relationship between the proteins from the two sources in the sense of one making good the amino-acid deficiencies of the other. The results of feeding maize proteins with wheat gluten are of particular interest, however, because of their pronounced effect in promoting growth despite the relatively low lysine content of both the wheat and maize proteins.

Gelatin with its high lysine content does not improve the proteins of the maize kernel.

#### STOCK RAISING

569 - Live Stock Production in the Eleven Far Western Range States, U. S. A. — BARNES, WILL C. and JARDINE, J. T., in U. S. Dept. of Agriculture, Office of the Secretary, Report No. 110. 100 pp. Washington, July 1, 1916.

This report forms the second portion of the enquiry held by the U. S. Dept. of Agriculture into meat consumption and production (1). It relates to the following 11 Far Western Range States: Arizona — California — Colorado — Idaho — Montana — Nevada — New Mexico — Oregon — Utah — Washington — Wyoming and, particularly, to the land on and adjoining the National Forests.

The enquiry was conducted by 160 Forest Service Inspectors under the direction of the writers.

The data are presented in three sections:

1) Live-stock production on western ranges, including changes in production since 1910, the main factors responsible for these changes, and the possibilities for increase in production.

(1) See B. March 1917, No. 286.

(Ed.)



- 2) Cost of production at present under western range conditions.
- 3) Brief discussion of conditions in each State included in the investigations.

The following are the main facts elicited by the enquiry.

CHANGES IN NUMBER OF CATTLE AND SHEEP SINCE 1910. — From 1910 to 1914 there has been a decrease estimated at 859 120 head of cattle and 4 537 578 sheep. Considering four sheep to be equivalent to one cow this is equivalent to a decrease of approximately 13 %.

The entry and settlement of 85 673 397 acres of land since 1909 in the States under notice is responsible for an approximate decrease of 16 % in animal production from that date ; it is largely due to the dividing up of ranches formerly employed for ranging cattle and sheep.

The increase in prices and the development of farms in the range district has resulted in an increase in the cost of winter feeding and in a diminution of the area of pasture per head of cattle. These facts have partly counterbalanced the effects of settlement in relation to the decrease in numbers of cattle.

Among the factors responsible for the decrease from 1910 to 1914 may be mentioned : the uncertain outlook — difficulty of finding capital for purchase of breeding stock — increase in price of land and dairy stock — improvement in grade and weight of animals at the expense of numbers — drought and severe winters — range deterioration.

POSSIBILITIES OF INCREASED PRODUCTION IN THE FUTURE. — The conclusions reached under this head are as follows : The production of live stock in the 11 States under consideration is capable of a 15 % increase during the first 10 years, from 1915 to 1924 inclusive and this for the following reasons : a) the settlement of the 85 673 397 acres of range lands mentioned above will mean increased development of animal production ; b) the carrying capacity of summer pastures, including those of the National Forests, will probably increase 15 % and winter feeding in the stable in the regions adjoining the National Forests will probably increase in a similar manner ; c) the improved method of handling stock both on farms and ranges will mean a more economic utilisation of feeds and so the raising of an increased number of cattle with the same means.

This estimated increase of 15 % for the National Forest ranges will require improved breeding methods. Better use of pasturage can be made by sinking wells, building roads and bridges, etc., and this will allow of bringing into use an increased amount of range. The cooperation of the Forest Service will be required to help in attaining this result and the adoption of a liberal policy with regard to the construction of drift and division fences, roads, bridges, etc. In the 11 States in question there remain some 284 000 000 acres of unreserved and unallotted public lands, of which about 250 000 000 acres are essentially grazing lands. Under adequate control, with the necessary development and improvement, these lands would within 10 years probably carry 30 per cent more stock than at present. But without some form of control the best that can be hoped for is the maintenance of the present carrying capacity.

TABLE I. — Averages, by States, of data supplied by stockmen in answer to question schedule.

State	Length of grazing period month	Cost of grazing		Pasture and fodder consumed up to 1 year	Duration of winter feeding month	Winter feed consumed per head of cattle from yearlings up	Average cost of winter feeding where carried out by contract	No. of bulls per 100 cows	Average value of bulls	Average no. of calves born per 100 cows	Percentage loss of cattle from all causes			Yearly depreciation of range cows	Yearly depreciation of bulls	Rate of interest for loans on cattle	Average weight of cattle sold direct from range or pasture		Yearly labour cost per head of adult cattle	Rate of taxation per \$ 100	Head valuation for purposes of taxation
		Per cow and calf	Per head of other cattle								Calves up to 1 year	1 year to 2 years	2 years up-wards				2 year old	3 year old			
Arizona . . . . .	12	1.26	1.16	—	—	—	—	6.00	82.00	57.00	8.30	4.40	6.40	6.00	12.70	9.90	774.0	935.0	2.43	2.02	23.01
California . . . . .	10	6.22	5.51	11.83	2.00	7.18	9.32	3.73	94.75	73.55	6.76	4.15	4.12	4.95	17.22	8.10	968.2	1146.6	2.94	2.12	19.19
Colorado . . . . .	7.4	2.35	2.12	9.80	4.60	8.56	8.80	4.16	131.90	69.30	8.03	4.90	4.54	5.26	18.32	8.82	883.0	1084.5	2.76	2.36	35.66
Idaho . . . . .	7.5	2.25	2.15	8.35	4.00	8.50	8.00	4.00	100.00	75.00	7.00	4.00	3.00	12.00	16.00	10.00	1000.0	1200.0	2.95	2.00	30.00
Montana . . . . .	8.0	3.97	3.07	9.02	4.00	8.04	9.20	3.44	138.00	73.80	7.04	3.87	2.74	4.74	17.50	9.69	991.0	1211.0	3.87	2.63	29.89
Nevada . . . . .	8.0	3.00	2.56	7.28	3.50	7.57	7.95	4.00	93.00	70.00	6.00	4.00	4.00	6.00	17.00	8.00	940.0	1140.1	2.75	1.88	20.00
New-Mexico . . . . .	11.2	1.24	1.10	1.00	0.20	—	—	5.00	83.00	66.00	10.60	5.60	5.80	5.80	13.40	10.20	725.0	934.0	2.77	4.61	28.00
Oregon . . . . .	8.59	3.94	3.51	9.92	3.41	7.61	8.05	4.04	113.35	75.74	5.39	3.27	3.00	3.35	13.50	8.42	275.7	1185.9	3.53	1.85	25.80
Utah . . . . .	9.0	2.06	1.96	7.65	3.50	7.65	8.15	4.00	93.00	69.00	6.00	5.00	5.00	8.00	15.00	8.00	900.0	1085.0	2.95	3.88	20.00
Washington . . . . .	7.9	5.47	5.19	8.61	4.10	9.92	12.25	3.72	124.15	79.48	5.33	4.78	3.70	5.24	14.70	8.70	1032.0	1225.0	3.71	3.20	25.61
(1) Wyoming, District No. 2	7.8	3.76	3.72	8.65	4.15	6.64	7.30	5.52	160.50	73.20	5.87	3.92	2.79	3.58	18.00	4.50	937.0	1155.0	2.33	1.62	30.42
Wyoming, District No. 4 .	7.0	3.14	1.89	9.33	5.00	8.33	9.75	4.00	132.00	83.00	7.00	3.00	3.00	7.00	12.00	9.00	1075.0	1300.0	1.87	2.29	32.00

(1) These are the district divisions of the Forest Service. District 4 covers the Teton and Wyoming National Forests south of Yellowstone Park and lying adjacent to the Idaho State line. District 2 covers the rest of the State.

By the use on the ranges of a higher grade and a greater number of bulls, the separation of breeding stock from dry stock and better care and management of the breeding animals throughout the year, it should be possible to increase the number of calves 10 per cent and the average weight of a 2-year old steer perhaps 30 lbs.

**COST OF PRODUCTION UNDER WESTERN RANGE CONDITIONS.** — The greater part of the data under this heading was furnished by the leading breeders in the form of answers to a question sheet distributed by the Inspectors of the Forest Service.

Table I shows, in the form of averages, for each State, the data supplied; these latter are of special interest for the study of the Western range pastures apart from the costs of production which have been calculated by their aid. Before proceeding to the calculation of the cost of production, the data have been carefully examined by the writers in person, zone by zone, with the same schedule of questions in order to obtain check data as accurate as possible.

In addition to the data in Table I the report reproduces a number of accounts supplied by some big stock-raising enterprises. These are compared with the average expenses calculated by the writers.

For instance, the following statement is from a large range outfit in central Arizona which ranges 17 000 head of high-grade cattle.

Sundries . . . . .	\$ 4 828.00
Labour . . . . .	14 317.00
Supplies . . . . .	5 753.00
Feed . . . . .	23 870.00
Taxes . . . . .	4 706.00
<hr/>	
Total cash outlay . . .	53 474.00
Cost per head based on actual running expenses	3.13

Of these 17 000 head, 8333 are bearing cows, 416 are bulls, the balance, about 8 250 head, are mixed young stock. A depreciation charge of 5 % for cows and 15 % for bulls would run the above total to \$ 80 546 or a total cost of \$ 4.74 per head. Dividing the 5 000 calves produced into this \$ 80 546 cost and depreciation, gives a cost of \$ 16.11 to produce one calf, but this, of course, makes them bear the burden of the whole herd, which is hardly fair.

The average annual branding for the company is 5 000 calves, or about a 60 % crop. The company pays 48 cents per head for grazing fees on the National Forests for the year-long period for a small number of their cattle, the majority of them being grazed on a near-by Indian reservation at a cost of \$ 1.50 per head. The company's total investment is approximately \$ 500 000. In the States of Arizona, New Mexico, South Colorado and Texas, outfits pasturing over 2 000 head work under practically similar conditions.

Table II shows the cost, by States, of producing a yearling and a 2-year old, as compiled from the data collected by the writers.



TABLE II. — *Average Cost, by States, of producing a yearling and a 2-year-old steer or heifer.*

State	Yearling	Two-year-old
<i>Arizona:</i>		
Average figures of Table I . . . . .	\$ 19.45	25.27
Special report of large range outfit . . . . .	15.43	20.30
<i>California:</i> Average figs. of Table I. . . . .	27.57	40.00
<i>Colorado:</i> Average figs. of Table I. . . . .	30.50	43.46
<i>Idaho:</i> Average figs. of Table I. . . . .	31.34	45.10
<i>Montana:</i>		
Average figs. of Table I. . . . .	32.89	47.90
Special report for eastern Montana . . . . .	26.90	35.60
<i>Nevada:</i> Average figs. of Table I. . . . .	31.25	44.46
<i>New Mexico:</i> Average figs. of Table I. . . . .	18.36	25.30
<i>Oregon:</i> Average figs. of Table I. . . . .	31.13	45.70
<i>Utah:</i>		
Average figs. of Table I. . . . .	31.43	44.66
Schedules in southern Utah only . . . . .	19.08	24.35
<i>Washington:</i> Average figs. of Table I. . . . .	33.45	50.54
<i>Wyoming:</i>		
Average figs. of Table I. . . . .	31.88	40.17
Special report of large outfit . . . . .	25.75	35.29

## SHEEP

570 - Hereditary Transmission of the "Curly Wool" Character of Karakul Sheep in Crosses between the Karakul and Rambouillet Breeds; Research carried out in Austria. — ADAMETZ, LEOPOLD, in *Zeitschrift für induktive Abstammungs- und Vererbungslehre*, Vol. 17, Pt. 3, pp. 161-202. Leipzig, March 1917.

Breeders of Karakul sheep (1) of the Bokhara district (Central Asia), as well as most fur merchants of central Europe, consider the lock of Karakul lambs to be a specific product of their native habitat, outside which this character is not maintained. This was also Darwin's theory.

In order to clear up this point and to gain a better knowledge of the inheritance of the curl, crossings between Karakul sheep and Rambouillet sheep (whose lambs have straight wool) were carried out at the experimental farm of the "K. K. Hochschule für Bodenkultur" (High School for Agriculture) at Gross-Ezersdorf (Austria). Unfortunately the experi-

(1) See also *B.* January 1917, No. 64.

(Ed.)

ments were unavoidably carried out under rather unfavourable conditions: as only 50 animals were available, only pure-bred Karakul rams were crossed with pure-bred Rambouillet ewes. In spite of their deficiencies, the experiments permitted the determination of the principal factors in the inheritance of the Karakul curl. The results were compared with those obtained by other breeders from crosses between the Karakul and Zackel breeds (2).

RESULTS OF THE EXPERIMENTS. — 1) The Karakul curl is a strictly hereditary character which is transmitted even if Karakul sheep are crossed with other races of which the lambs have wool which does not curl.

2) With regard to this character such crossings produce characteristic Mendelian segregations.

3) The capacity of Karakul sheep to form these typical locks is, therefore, a character which is never caused by the natural conditions of the Bakhara district, but is rather a phenomenon of domestication due to a mutation.

4) The capacity of forming Karakul locks is probably an incomplete dominant character in the Mendelian sense, as is the case with curls in certain human hair.

5) The incomplete dominance of the formation of curls is also seen by the fact that, already in the hybrids of  $F_1$ , the fleece of the lambs varies greatly; some of the animals have no curls, others have curls like those of pure-bred Karakuls of the 1st. quality, and there are all kinds of intermediate animals.

6) With regard to the hereditary force of curl formation, especially in the  $F_1$  generation the results vary in the different Karakul rams; this may be attributed to the individual strength of the animals.

7) The extent of curl formation in the lambs of the  $F_1$  generation depends also, all else being equal, on the second race without curls chosen for crossing. Breeds with mixed wool ("Mischwollrassen"), especially the Zackel breed give, very good quality curls in the  $F_1$  generation; on the other hand, Merino sheep give bad quality curls. The absence of curls in the fleece of lambs derived from crossing Karakul and Rambouillet breeds is the result of atavistic crossings.

8) As the curls only appear in very young animals, their formation may be described as an incomplete and temporary dominant.

9) The varying behaviour of the hairs which form the curl at the different stages of the development of the fleece leads to the supposition that there is a close relationship between curly flat-lying hair on the one hand and curly, vertical hair and very wavy and slightly wavy hair on the other.

10) It is clear that the shape of the lower part of the follicle cannot be the cause of this varying behaviour of the hairs.

11) The mode of action of the mechanical forces during the formation of Karakul curls is not known.

12) The histological character of the different kinds of hair cannot, therefore, form a practical base in the choice of factors.

13) Unlike the less complete curls in human hair due to one factor only (in the white race, according to DAVENPORT), or, at the most to 2 factors (in Hottentots with very curly hair, according to FISCHER), the appearance of the of the Karakul curl, so far as can be judged by the results obtained, is probably caused by more than 2 factors.

14) If the manner in which the locks are transmitted within the pure-bred Karakul race itself is considered, it appears probable that a great many factors are concerned, all of which act in the same sense ("polymerism"), according to NILSSON-EHLE's theory.

15) The hypothesis that the capacity of forming curls in the Karakul race depends on a large number of factors acting in the same sense is corroborated by the fact that in the more complicated crossings made by the author ( $F_2 \times F_2$  and  $F_1 \times F_2$ ), there were often lambs whose fleece pointed to a sort of intermediary inheritance.

16) This explanation is contradicted by the fact that, even after repeated reciprocal crossings on the Karakul side, there still appear from time to time lambs without curls. This is probably a case of heterozygotes of a recessive type. The author considers improbable DAVENPORT's hypothesis, that there exists a force which exercises a different activity, and, according to the circumstances, can cause these incompletely dominant characters to develop or else leave them in the latent state.

## POULTRY

571 - **The Cost of Raising Leghorn Pullets.** — PHILIPS, A. G., in *Purdue University Bulletin*, Vol. IX, No. 196, 20 pp., 6 fig. Lafayette, Indiana, December, 1916.

Experiments were carried out at the Agricultural Station of Purdue University in order to determine the actual cost of growing a Leghorn pullet from the chicken stage to laying age. The experiments also bore upon the number of eggs required to hatch a pullet, the percentage of pullets in a flock, the possible income from cockerels with their influence on the cost of the pullets, the cost of feed, fuel and labour, and the length of time necessary to grow a pullet.

Five experiments were carried out over a period of 165 to 175 days, from spring to autumn. The chicks were reared in 8ft.  $\times$  8ft "A" shaped colony brooder houses, heated by gasoline. Clean land, plenty of green feed and abundant shade were available throughout the experiment.

Except for minor differences, the average ration used was as follows :

*Grain* : 2 lbs. sifted cracked corn (fine) ; 2 lbs. sifted cracked wheat ; 2 lbs. steel-cut oats.

*Mash* : 2 lbs. bran ; 2 lbs. shorts ; 2 lbs. corn meal ; 0.15 lbs. charcoal ; 1 lb. meat scrap ; 0.8 lb. ground dry bone.

*Green feed, grit and skim milk* : in abundance.

When the chicks reached about 0.7 lb. in weight, the grain was changed to cracked corn and whole wheat.



*Prices of Feeds per 100 lbs.*

Feed	Experiment No. 1	Experiments Nos. 2 and 3	Experiment No. 4	Experiment No. 5
Cracked corn (fine) . . .	\$ 1.80	\$ 1.60	\$ 1.60	\$ 2.00
Cracked corn. . . . .	1.80	1.60	1.60	1.70
Wheat. . . . .	1.50	1.45	1.45	1.60
Cracked wheat . . . . .	3.00	2.15	1.65	3.25
Steel-cut oats . . . . .	3.50	2.65	2.65	3.00
Bran . . . . .	1.60	1.30	1.50	1.50
Shorts. . . . .	1.70	1.50	1.60	1.70
Corn meal . . . . .	1.90	1.45	1.80	1.70
Charcoal . . . . .	2.30	2.30	2.30	1.60
Meat scraps . . . . .	2.50	2.50	None fed .	2.60
Skim milk . . . . .	0.30	0.30	0.25	0.25
Bone . . . . .	2.00	2.80	3.00	2.75
Grit . . . . .	1.00	1.00	0.53	0.60

The results of the experiments are summarised by the writer as follows;

1) Based on four seasons' work and several thousand chicks hatched, it required 1.83 eggs set for every Leghorn chick hatched.

2) The cost of hatching these eggs was \$ 0.021 per chick, which, when added to the cost of eggs, increased the total cost of a chick when hatched to \$ 0.057.

3) Based on the first twelve weeks of life, it took 5.69 pounds of grain and mash and 5.07 pounds of milk, costing \$ 0.1434, to feed a Leghorn chick. During the same time, it took 3.59 pounds of grain and mash and 3.41 pounds of milk, costing \$ 0.084, to produce one pound of gain.

4) When figuring cost of feed, fuel, labour and litter the whole cost of one pound of gain was \$ 0.154.

5) The average Leghorn pullet twenty-four weeks old and ready to lay, weighed 2.75 pounds.

6) The feed was by far the most expensive item in the cost of rearing chicks.

7) On the basis of 100 chicks hatched and a 17 per cent. mortality the percentage pullets and the percentage of cockerels were 40.1 and 42.9 respectively.

8) The time of hatching greatly influenced the rate of growth of chicks, price of broilers, net cost of growing, and weight of pullets at laying age. Early hatching paid best. Early cockerels were sold at a profit. May-hatched broilers sold at a loss.

9) The gross average cost of a pullet was \$ 0.434. This, less profits in cockerels, made the net cost \$ 0.381.

10) Mortality varied and influenced the final cost, The average mortality of 999 chicks was 17 per cent.

11) For every pullet reared it required the setting of 4.57 eggs.

12) Cockerels grew more rapidly than pullets.

572 - The Use of Phototaxy in Selecting, from the Moment of their Birth, those Larvae of *Bombyx mori* most Resistant to the Disease "Flacherie". — ACQUA, C., in *Informazioni Seriche*, Year IV, No. 3, pp. 50-52. Rome, February 5, 1917.

In a previous paper (1) the author described many experiments carried out to determine the action of light on the movements of *Bombyx mori*. One of the most striking results obtained was that the newly-hatched larvae immediately turn to the source of light; this movement diminishes during the following days and disappears entirely at the end of the first stage. During the subsequent stages there is, on the contrary, an inverse, but less energetic movement, and the larvae tend to avoid light.

In the new experiments the long, wide glass and paper tubes, completely darkened except at one end, were replaced by half-darkened rooms into which the light entered from one side only though one half-open window. Sheets of paper were arranged on the table so as to form a rectangle a little more than 1 metre in length with the large axis parallel to the rays of light from the window. The eggs were placed on the extremity of the rectangle furthest from the window on a band parallel to the small side of the rectangle. This band was 3 cm. wide and 35 cm. long, and capable of holding about 15 gr. of eggs.

The newly-hatched larvae turned rapidly towards the window, crossing, according to their specific capacity, one or many sheets. After 1 to 2 hours the movement had greatly increased, but, although they emerged practically at the same time, all the larvae did not show equal resistance or equal speed. One batch of larvae easily crossed the distance of about 1 metre, whereas others travelled shorter distances, while some hardly left the spot where they were born. The batches showing different reactions towards light were collected separately and bred separately. Excess of light diffused all round caused the worms to move in all directions. Even in these cases it was possible, by another method, to collect the batches showing different reactions. The first experiments, carried out in spring, aimed at determining whether the division of the larvae into 2 groups showing a different reaction corresponds to a difference in sex. The result was entirely negative, the proportion of males and females being equal in both groups.

During the summer and autumn, attempts were made to determine if the difference in the phototactic reaction of the larvae corresponds to different degrees of robustness, and consequently, different degrees of resistance to "flacherie". For this purpose it was necessary to use larvae susceptible to the disease. This was easily done by using eggs treated with hydrochloric acid immediately after they were laid, by the methods usually employed.

Eighteen experiments were carried out with pure and hybrid native chinese eggs. The different groups were bred under absolutely identical conditions so that various external conditions should have no influence on the eventual mortality.

(1) See B. 1916, No. 328.



The results of the experiments were constant : *the larvae which were most resistant to "flacherie" were those which, from the time of their birth had travelled furthest.* Original weakness by which some of the larvae were destined to die off was manifest much earlier in those groups which showed a limited phototaxic activity. In the case of an incomplete harvest, it was always the groups with the greatest phototaxic activity which gave the greatest number of cocoons. The results were always similar whether the experiments were carried out by the author himself or by breeders to whom batches were given without their knowing their phototaxic activity.

Only the last 4 experiments are described. These were carried out in late autumn with double-yellow larvae whose premature hatching was caused by treatment with hydrochloric acid ; this was the second time this process was adopted in the year. In order to accentuate more greatly the difference between larvae with a weak or a strong phototaxic activity only those groups were reared which had showed the most marked differences, that is to say ; 1) the larvae which had moved most rapidly more than 1 metre towards the source of light, 2) the larvae which had remained in the immediate proximity of the place where they were born.

The results are given below, *P* represents the larvae which remained very near their birthplace ; *L* those which travelled furthest from it.

1st EXPERIMENT. — Hatched on September 27th., the two groups originally contained 1845 larvae each.

RESULTS : *Group P.* — Mortality, which was very great, commenced after the 3rd. moult; the group was completely destroyed shortly after the beginning of the 4th.

*Group L.* : In good condition to the end of the last stage ; on November 4th., 1800 larvae reached their full growth on heather. 1166 good cocoons were obtained, only half of which gave moths, the chrysalides of the other half having died before being hatched.

2nd. EXPERIMENT. — Hatched on September 29th., the two groups originally contained 1420 larvae each.

RESULTS : *Group P.* — As in the preceding experiment ; the group was completely destroyed between the 1st. and 2nd. days of the last stage.

*Group L.* — In good condition to the end. On November 20th., 1240 larvae were placed on heather ; 890 good cocoons were obtained, but there was a great mortality before the chrysalides hatched.

3rd. EXPERIMENT. — Hatched on October 3rd.; the two groups originally contained 1260 larvae each.

RESULTS : *Group P.* — Mortality set in at the first stage ; all the worms died before the 4th. moult.

*Group L.* — In good condition to the end. Placed on heather on November 4th. 900 good cocoons were obtained, but the majority of the chrysalides died before hatching.

4th. EXPERIMENT. — Hatched on October 5th., the two groups originally contained 860 larvae each.

RESULTS. — *Group P.* : All the larvae died before the 3rd moult.

*Group L.* — In good condition to the end ; all the larvae reached their full development on heather on November 20th., and spun their cocoons, but the majority of the chrysalides died before hatching.

These facts are perfectly clear and it seems that both rearers of silk-worms and egg producers might use them to their advantage.



The rearer could place the eggs, in the manner described above, on the shelves of the nursery in incubators with light coming from one side only. Those larvae which travel a distance of from 10 to 15 cm., for example, (this happens very quickly), will be collected, and the rest refused. It will then be certain that the worms most susceptible to "flacherie" will have been eliminated.

The author is testing a special incubator capable of automatically effecting this selection. By this method egg-producers will also be able to choose the larvae which show the greatest resistance to "flacherie".

If the selection is rigorously carried out the larvae chosen will be few and will perhaps not suffice for all the demands of a year, but they will form the basis for the breeding for the following year; the selection will then be repeated and so on.

573 - **The Consumption of Mulberry Leaves by Silkworms and the Influence of the Consumption on :** 1) **The Relation between Nervures and Parenchyma in the Leaves ;** 2) **The Proportion of Fruits on the Branches.**—VIGIANI, D., in *Il Coltivatore* Year 63, No. 9, pp. 293-295, 2 fig. Casale Monferrato, March 30, 1917.

The principal qualities required of good mulberry varieties are : late budding ; rapid and complete maturation of the wood ; narrow pith ; compact wood ; consistent and thick leaves, not too watery, but having abundant parenchyma ; nervures weakly developed ; small production of fruit ; leaves easily gathered, resistant to dessication, and can travel well.

Using his own researches as a basis. Prof. ARCANGELI has classified in decreasing order of value, and in relation to the abundance of parenchyma, the most common species and varieties of mulberry : 1) "Fiorentina" ; 2) "Venosa" or "nervosa" ; 3) "arancina" ; 4) *Morus nigra* ; 5) Philippines mulberry.

Table I, which gives the results of work done by M. GRAMIGNANI, shows the notable influence that the relation between the quantity of nervures and parenchyma has on the weight of leaves necessary to rear 1 ounce of eggs (30 gr., giving 40 000 silk-worms).

TABLE I. — *Results of the experiments made by M. Gramigiani.*

Varieties of mulberry	100 kg. of leaves contain		Consumption of leaves per ounce of eggs	Weight of cocoons obtained from one ounce of eggs
	nervures	parenchyma		
Limoncina . . . . .	19 kg	82 kg	1 600 kg	80 kg
Selvatica . . . . .	12	87	800	86
Veronese . . . . .	19	81	1 100	81
Cattaneo . . . . .	31	69	1 200	79

These figures show that the varieties with fine, short nervures give an economy of 50 % of the amount of leaves necessary, besides giving a better yield of cocoons.

The writer made the same observation on rearings carried out at the "Vegni" Agricultural Institute under the auspices of the Minister for Agriculture. He further observed the great influence exercised by the quantity of fruit (left on the branches given to the larvae during the last 2 stages) on the feeding value of the different varieties.

Table II shows that, from one variety to another, the proportion of nervures and fruit is notably different. These characters should, therefore, be taken into consideration when choosing mulberry varieties for propagation.

TABLE II.

*Proportions of nervures and fruits in various varieties of mulberry.*

Varieties of mulberry	Kg. of nervures in 100 kg. of leaves	Kg. of fruits per 100 kg. of leaves
Selvatico . . . . .	26.510 kg	4.444 kg
Gentile . . . . .	28.570	56.720
Limoncino . . . . .	26.530	7.051
With red fruit. . . . .	26.373	80.430
Cattaneo . . . . .	32.000	41.384
Arancina . . . . .	33.890	—
Piangenti . . . . .	28.070	89.350

## FARM ENGINEERING.

574 - **Ploughing with a Tractor.** — RINGELMANN, MAX, in *Journal d'Agriculture pratique*. Vol. 29, No. 25, pp. 435-438, 4 fig; Vol. 20, No. 6, pp. 103-106, 5 fig. Paris, Dec. 14, 1916, and March 22, 1917.

AGRICULTURAL  
MACHINERY  
AND  
IMPLEMENTS

The organisation of a contracting business for ploughing by mechanical power forms a new field and requires special technical knowledge. The writer attempts to lay down the principles upon which the necessary technique should be built, in the understanding that it rests with practical experience to test the value of theory.

He considers: 1) the width to be given to the lands, using a tractor towing the majority of single breasted ploughs; 2) the width to be given to each headland in order to facilitate the work by reducing the time required for turning. With regard to the width of the lands the writer proposes the two following principles:

1) it is apparently advisable to make the lands as wide as possible; there is, however, a practical limit.

2) it is advisable to calculate closely the width of the lands, which should be a multiple of the gang-width.

With regard to the working of the widest lands the writer gives, in the accompanying table, for a plough of which the gang-width is 1 metre, the distance to be travelled along one of the headlands of a half-ridge, the

distances along the two headlands, and for purposes of comparison, per half-ridge, the average distance which the plough has to travel along the two headlands on each journey.

Per half-ridge, for 1 headland			Per half-ridge for the 2 headlands	
Width of half-ridge	Number of gang-widths	Distance travelled along headland	Distance travelled	Average distance travelled per journey
5 metres	5	15 metres	30 metres	6 metres
10	10	55	110	11
15	15	120	240	16
20	20	210	420	21
25	25	325	650	26
30	30	465	930	31

It follows that for a land 60 metres wide, whatever its length, the distance travelled along the headlands would be about 2 kilometres which re-

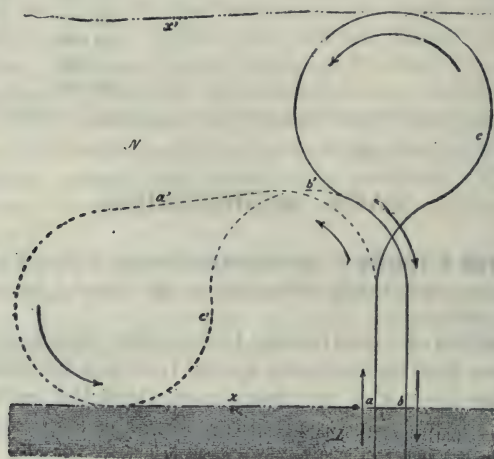


Fig. 1. — Plan of a figure-of-eight turn.

presents, according to recent trials by the writer, a consumption of 2 to 3 litres of gasoline.

The last column of the table is the most significant, and it would not seem advisable to make the lands more than a score of metres wide; it is probable that about 30 metres is the maximum.

The soil of the headland becomes rough and this state increases with the number of journeys necessary to plough a half-ridge. As a result, teams will find the headland difficult to work.

The width of the lands must be calculated closely, or else in ploughing



the last strip of each half-ridge the tractor will be obliged to go over ground already worked.

Further, in order to "work well", it is advisable to leave, between the outer edge of the driving wheel and the side of the preceding furrow slice, a distance of at least 20 cms; on the other hand, in tractors with double drive, the distance between the outer edges of these wheels varies between

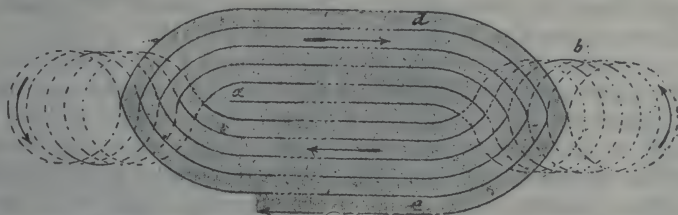


Fig. 2. — Plan of figure-of-eight ploughing.

1.4 and 2.5 metres, and another 40 cms. must be added for convenience in working; it results from this that the width covered by the last journey will not be sufficient and a strip will be left over which will require finishing with horses. This drawback can be surmounted in 2 ways: 1) by the use

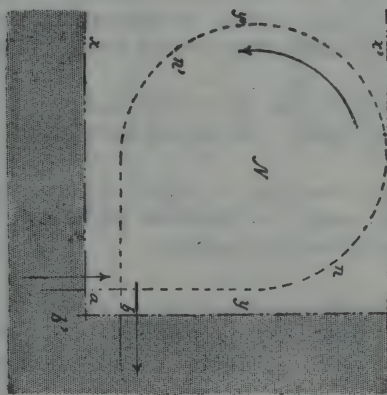


Fig. 3. — Plan of right-angle turn.

of a motor with single driving wheel; 2) by adopting in and out ploughing).

Tractors with single driving wheel show, in addition to certain mechanical advantages (simplification, suppression of the differential, etc.), that of being capable of working strips as little as 1 metre wide, as one of the guiding wheels can quite well pass over land already ploughed.

With in-and-out ploughing, the above mentioned difficulty is dimin-

ished if a tractor with double drive is employed, because there only remains a practically insignificant strip (relatively to the remainder of the field ploughed with the tractor) to be finished with horses, and it disappears entirely if a tractor with single driving wheel is employed.

With regard to the width to be given to the headland, it is, in the case of animal power, a function of the number of animals in the team. In the case of tractors, it is of the same order of magnitude, considering that the plough drawn by the machine could only be replaced by a team of 6 to 10 strong oxen requiring 10 to 17 metres of headland.

As the length of a tractor and plough covers 7 to 8 metres, one will require for a right angled turn a radius of at least 3.5 metres and the width of the headland will be at last 7.7 to 8 metres. In practice, in order to turn more easily without loss of time, headlands are kept at from 9 to 12 metres.

When the distance between two successive tracks is to be less than 7 to 8 metres, recourse must be had to the figure-of-eight turn, where the machine, on reaching *a* (fig. 1) at the edge *x* of the ploughed portion *L*, turns along the circle *c* in order to return to *b*, this point being as close as one likes to the point *a*. The circle *c* being at least 7 metres in diameter, the width *xx'* of the headland *N* is at least 14 metres, and usually exceeds 15 metres. If it were necessary to reduce the width of the headland *N* (at least 8 metres), one would have to turn along the dotted line *a a' b b'*. In England and the United States, it is proposed to adopt the figure-of-eight method of ploughing (fig. 2), but this the writer does not recommend as one should avoid having to work while turning, at any rate on those portions in which the curve is cramped; finally this method means starting the work in mid-field.

The *right-angled turn* (fig. 3) is also used when the tractor takes the place of a reaper and binder; one should have at one's disposal a space *N* of 8 to 10 metres.

To sum up, in the same way as with team ploughing, one should avoid turning too abruptly, and it is advisable to lighten the driver's work by making the headlands as wide as possible.

575 - **Tractor Plough Adjustments and Hitches.** — REED, C. O., in *Farm Implement News*, Vol. XXXVIII, No. 9, pp. 26-27, 6 fig. Chicago, Illinois, March 1, 1917.

The true line of pull in a double drive tractor may be considered to pass midway between the two wheels as shown in fig. 1.

If the plough is not attached over this true line of pull side-draft will result in the motor, power will be lost, the gears will wear unevenly and the front wheels of the engine will tend to slide toward the ploughed ground. In addition, side-draft will result in the plough and the work will be badly done. The work is done under the best conditions when the resultant of the traction coincides with that of the resistance of the plough; this does not happen often, as the tractor is so much larger than the plough, and side-drafting inevitably results.

The method of attachment considered by the writer as a good one is as follows:

As soon as the first furrow has been turned, place the engine as near as possible to the open furrow and carefully arrange the gang plough in its proper relation to the furrow. With a nail, scratch two marks on the draw bar of the engine, one to show the position of the true line of pull

### Tractor plough hitches.

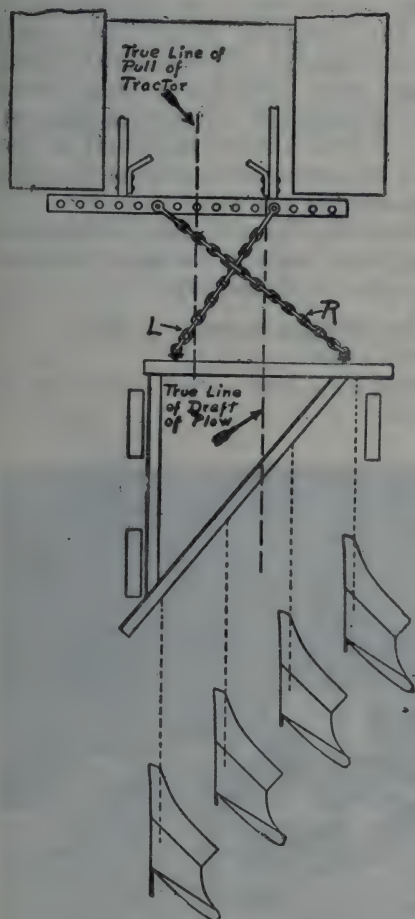


Fig. 1. — Hitch for tractor with a double drive-wheel.

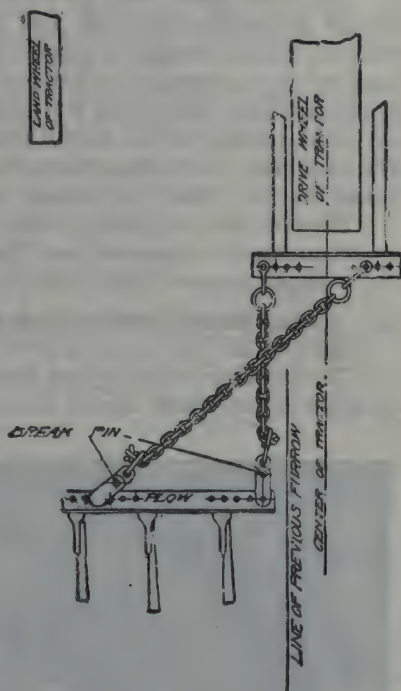


Fig. 2. — Hitch for tractor with a single drive-wheel.

of the tractor and the other to show where the true line of pull of the plough would cut the draw-bar. Then attach the chains in such a way that the cross in the chains is behind a point on the draw bar midway between the nail marks. If the crotch chain or bar hitch be used, bring the point of attachment to the draw-bar midway between the marks. If



much side-draft appears in the engine on starting work, the chains should be moved to the left on the draw-bar, while the chain *R* (fig. 1) should be lengthened. If there is much side-draft in the plough, the chains should be moved to the right on the draw-bar and the chain *L* (fig. 1) should be lengthened, thus applying the power nearer the true line of draught.

The same effect could be produced by shortening the chains *R* and *L* instead of lengthening them, but as most operators are inclined to hitch too close, it is advisable to suggest lengthening only, for side draft is usually more noticeable when short hitches are used. The shorter chain should be at least three and a half feet long. A couple of feet of extra chain will not make turning at the ends difficult if wide enough headlands are left. The long hitch has its disadvantages if the system is followed of ploughing round the field from the outside towards the centre.

The true line of pull of a single drive wheel tractor may be considered for all practical purposes to pass through the centre of the rim of the drive. Fig. 2 shows a cross chain hitch for a tractor of this type.

576 - **Spading-Machine of Wheel Barrow Type for Small Farms.**— *Scientific American*, Vol. CXVI, No. 8, p. 204. 1 fig. New York, February 24, 1917.

This spading machine was invented by a New Jersey farmer for use on small farms where labour is scarce.



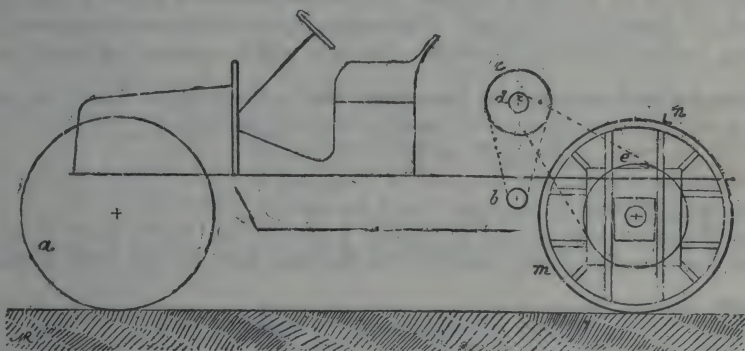
Spading machine: side view.

The machine is very light and can be handled like a wheel barrow. There are 2 spading forks, arranged to work alternately, and 2 sets of

springs both connected to the shanks of the spading forks, one set above, the other below the pivot. In this way they counterbalance each other. The springs are adjustable so that the spades can yield in one way or the other when they meet a hard obstacle. Each fork is driven by a piston and controlled by a small 8 HP internal combustion engine carried on a truck body with plough handles for guiding and controlling.

577. - **A Touring Car converted into a Tractor.**— RINGELMANN, MAX, in *Bulletin de la Société d'Encouragement pour l'Industrie Nationale*, Year 116, First Half-year, Vol. 127, No. 1, pp. 214-215, 1 fig. Paris, January-February, 1917.

Some time ago M. DE SALVERT, an engineer and agriculturist of Provins (Seine-et-Marne, France), converted an old touring car into a tractor,



Method of converting a motorcar into a tractor.

which he used on for some time on his Limoreau farm and then sent it to the trials at the Champagne farm where it was sold.

The accompanying figure shows how the car, a 18 HP touring PANHARD, type U2, chain-driven, 1907 model, was converted. The coach-body was removed, only two seats being left for the driver and another person. The wheels were replaced, the front wheels by 2 iron wheels *a* from an old binder, the back wheels by 2 iron wheels *m* built of sheet iron plates, with a tyre about 30 cms. wide. In order to reduce the speed while the motor works at the same rate, at each end of the driving shaft a gear wheel was placed so as to drive the wheel *e* fixed to the rear wheel through an intermediary transmission wheel *c*. As the diametres of the gear wheels required to reduce the speed to the required amount are known, as well as the speed and length of the chains, the right position of the axle *x* in relation to the driving shaft *b* and the wheel *m* is easily calculated. The wheels *c d* run on an axle fixed on brackets bolted on the frame and are lubricated by a cup.

The grip of the driving wheels on the soil is provided for by a receptacle placed on the rear of the frame which can be filled with weighty material. In working, a front and back wheel run in the furrow previously



opened. The tyres of the driving wheels are provided with a number of iron pieces *n* projecting about 8 cms. to afford a good grip.

With a double-brabant BAJAC plough with latticed mould-boards working at a depth of 25 cms. on a width of 37 cms., the tractive effort was found by M. DE SALVERT at the Champagne test to be 650 kg. equal to 70.2 kg. per square decimetre and corresponding to trials carried out by the writer with a similar plough in similar soil.

One hectare was ploughed in about 10 hours.

The tractor was used at Limoreau to pull 2 mowers having a knife beam 1.5 metres long; it was used with a harvester-binder with a knife beam 2.4 metres long. For carting, it pulled a cart with 350 sheafs of wheat in the field, while on the road it can pull a load of 4 tons.

According to M. DE SALVERT, the conversion of a touring car costs, at present, about 3 000 francs. The writer is of the opinion that, after the war, the conversion of old cars into tractors will be worthy of attention.

578 - **The Jullien Tool-holder for One-armed Men.** — RINGELMANN, MAX, in the *Bulletin de la Société d'Encouragement pour l'Industrie Nationale*, Year 116, 1st. Half-year, Vol. 127, No. 1, pp. 16-25, 14 fig. Paris, January-February 1917.

An apparatus for the purpose of enabling one-armed men to use the various agricultural implements such as spades, forks, etc.

In the apparatus shown in figures 1 and 2, the upper part *A*, which has the function of giving mobility to the tool held by the tube *B* placed

*JULLIEN Tool-holder for one-armed men.*

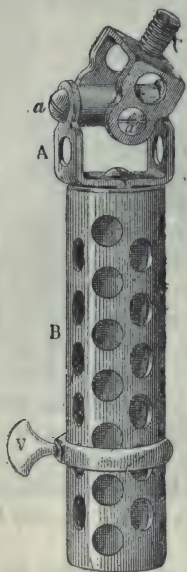


Fig. 1. — JULLIEN tool-holder.



Fig. 2. — JULLIEN tool-holder for a paralysed hand.



below, consists of two pivots  $a$  and  $a'$  which allow movement in any direction. The tube  $B$ , 95 mm. long and 36 mm. interior diameter, is so made as to take the shaft of a spade or other tool, made to fit exactly and held tight by a wingscrew  $V$ . The outer surface of the tube  $B$  is bored in various points so as to lighten the carrier.

For men with a paralysed hand, the JULLIEN apparatus has a slightly incurved iron plate so made that the fore-arm and hand rest on the plate, being held there with a leather sheath.

The apparatus can be fixed at the threaded part  $C$  by means of a lock nut (not shown in the figure) to the end of an artificial fore-arm or arm.

The first models weighed 375 gr., which was too light, causing doubts as to the strength of the universal joint, especially when the implement used acted by percussion, as is the case with picks, etc. For guiding the plough, the end of one of the stilts, suitably shaped, is fixed in the tube of the tool-carrier, while a spring takes up the vibrations.

The inventor has also designed for men having lost their fore-arm, a hammer-carrier with an anti-vibratory support which replaces the suppleness of the wrist and elbow and allows the one-armed man to hammer nails, etc. A rigid apparatus would tire the man very much and cause pain to the injured arm.

For planting out plants, M. JULLIEN has devised a simple spring-clip which is fixed at the end of an ordinary apparatus for a one-armed man.

579 - **The Width of Wagon Tyres Recommended for Loads of Varying Magnitude on Earth and Gravel Roads.** — MCCORMICK, B. E., in *United States Department of Agriculture, Circular No. 72*, 6 pp. Washington, February 22, 1917.

The recommendations in this circular are based on two factors: 1) the unit weight for width of tyre commonly used for road rollers, and 2) the results secured from a large series of traction tests conducted by the Office of Public Roads and Rural Engineering, extending over several years and made in widely scattered localities throughout the United States.

The following are the tyre widths recommended for wagons of different carrying capacities.

Type of wagon	Gross weight, loaded	Width of tyre
1 horse-wagon . . . . .	2 000 lbs	2 inches
Light 2-horse wagon . . . . .	3 500 "	2.5 "
Medium 2-horse wagon . . . . .	4 500 "	3 "
Standard 2-horse wagon . . . . .	6 800 "	4 "
Heavy 2-horse wagon . . . . .	7 500 "	5 "

580 - **A Humidifier for Lemon Curing Rooms.** — SHAMEL, A. D., in *United States Department of Agriculture, Bulletin No. 494*, 11 pp., 7 fig. Washington, D. C., January 16, 1917.

A series of experiments having for their object the control of humidity in lemon curing rooms, lead the writer to invent a humidifier for maintaining conditions of uniform humidity (1) in such places. The principle of the apparatus is that air, driven by an electric fan, is charged with moisture by passing through a series of strips of cloth dipping at each end in two water pans, an upper and lower one. The water rises by capillarity on the cloths which pass through slots with edges raised above water level and made in the bottom of the upper pan. The water then dropped

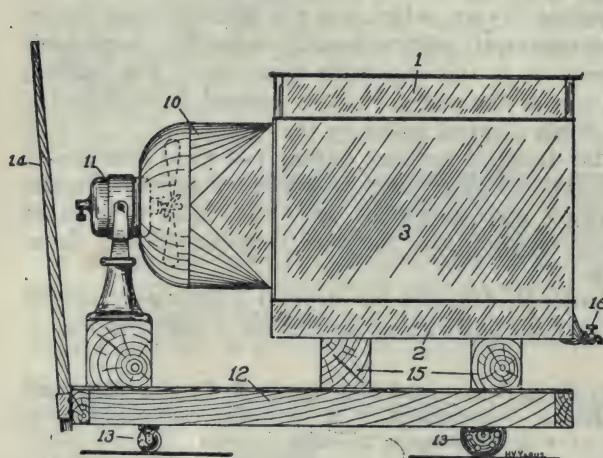


Fig. 1. — Side view.

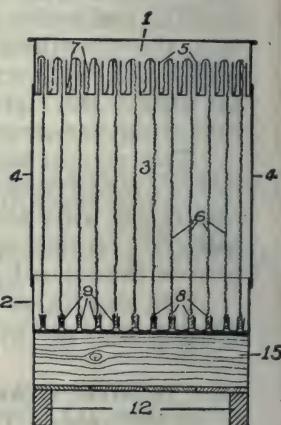


Fig. 2. — Transverse section.

down through the suspended cloths, by gravity and capillarity combined, into the lower pan.

The apparatus, shown in side view in fig. 1, is composed of an upper pan 1 36 inches long, 24 wide and 6 deep, and a lower pan 2 of the same dimensions. The two pans are separated by a chamber 3 in which are the strips of cloth. The walls of the chamber, which is open at both ends, are 36 inches long and 26 inches high and connect the upper and lower pans.

The pans, sides and other metal parts are made of galvanised steel. The corners of the cloth chamber are strengthened by angle irons.

The bottom of the upper pan has a series of parallel, raised slots (fig. 2), 4 inches high and with their upper ends spread slightly so as to allow the easy passage of the strips of cloth 6. The upper edges of the strips are drawn through the raised slots and allowed to drop down into the water in the upper pan. The bottom edges of the cloths are bound with sheet metal strips 9, the bound edges being held in the lower pan by springs or clamps 8. The strips of cloth are 35 inches wide so as to fit the raised slots

(1) See B., January 1917, No. 78.

and 36 inches long so as to extend from the lower pan through the raised slots and drop over into the water in the upper pan.

The walls of the chamber are prolonged as to form a circular hood **10** enclosing the electric fan **11**, which is 16 inches in diameter.

The humidifier, mounted on a truck **12** with 4 wheels **13**, can be moved about in any direction by means of the handle **14**. Supports **15** are placed under the humidifier and fan so as to raise them sufficiently to permit of a pail being placed under the spigot **16**.

When starting the apparatus, care should be taken to see that the edges of the cloths are submerged. Frequent readings of the humidity of the rooms should be taken, at first once every hour, by means of the sling psychrometer. The air temperature should also be taken. Readings must be made more often in variable weather.

The humidifier has been used successfully for two seasons in lemon curing rooms. The fruits have been cured better, as shown by better colour and firmness of the rind and greater juiciness of the lemons. The best conditions of humidity for curing lemons, as shown by these experiments, lies between 80 and 90 per cent. The apparatus has also been found to be very useful for improving the air conditions in living rooms of private houses.

The humidifier should not cost, apart from the electric fan, more than \$ 25.

For home use, a smaller type can be used.

#### 581 - Review of Patents.

##### *Tillage Machines and Implements.*

Canada	174 114	Harrow.
	174 176	Tractor plough.
France	482 569	Cultivator.
	482 745	Trailer for Brabant plough for use by a one-legged man or an invalid (1).
United Kingdom	104 156	Plough.
United States	1 217 172 — 1 217 383 — 1 217 776 — 1 218 681 — 1 218 743 — 1 219 720	Cultivators.
	1 217 257	Implement-shifting means for tractors.
	1 217 839	Plough.
	1 217 864	Adjusting mechanism for ploughs.
	1 218 064	Disc attachment for ploughs.
	1 218 121	Motor-cultivator.
	1 218 338 — 1 219 992	Harrows.
	1 218 436 — 1 219 880	Weeders.
	1 218 541	Combined weeder and cultivator.
	1 218 581	Spring-tooth for cultivators.
	1 219 342	Foot-piece for cultivators.
	1 219 636	Draft appliance for ploughs.
	1 219 793	Soil-pulveriser.
	1 220 136	Device for raising a harrow or plough from the ground.

(1) See B., March 1917, No. 270.

(Ed.).



*Manures and Manure Distributors.*

Italy	156 065	New process for manufacturing mineral superphosphates.
United Kingdom	17 384	Process for enriching guano with ammonium sulphate produced by synthesis.
United States	1 217 863 — 1 218 361 — 1 218 866	Fertiliser distributors.
	1 219 823	Discharge tube for fertiliser distributors.

*Drills and Sowing Machines, etc.*

Canada	174 100	Seeder.
United States	1 217 780 — 1 219 361 — 1 219 644	Seeders.
	1 218 712	Seeder and harrow.
	1 218 773	Fertiliser attachment for seed drills.
	1 218 820	Check-row attachment for planters.
	1 219 996	Corn-planter shoe.
	1 220 014	Attachment for planters.

*Control of Diseases and Pests of Plants.*

France	482 513	Improvements in the larger types of spraying machine.
	482 543	Trap for nocturnal insects.
Italy	155 666	Sulphur dusting apparatus.
United States	1 218 953	Spraying and powder dusting apparatus.
	1 219 049	Sprayer.
	1 219 875	Weed-cutter.

*Reapers, Mowers and Harvesting Machines.*

Canada	173 573	Knife-bar for lawn-mower.
	173 581 — 174 095 — 174 172	Stookers.
	173 886	Harvester and thresher.
	173 916	Brake for header harvesters.
United Kingdom	17 406	Lawn-mowers.
	17 491	Mowing machines.
	104 071	Harvesting-machines.
	104 165	Lawn-mowers.
United States	1 217 332 — 1 219 150	Grain shockers.
	1 217 408	Cotton-harvesting machine.
	1 217 449	Mowing-machine.
	1 217 629	Harvester.
	1 217 906	Automotor harvesting machine.
	1 217 933	Grain-heading machine.
	1 218 011	Bean and pea harvester and separator.
	1 218 924 — 1 219 322	Knife-bars for mowers.
	1 219 327	Corn-gatherer.
	1 219 676	Stalk cutting machine.
	1 220 132	Clover harvester.

*Machines for Lifting Root Crops.*

United States	1 218 532 — 1 218 860	Beet-harvesting machine.
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*Threshing and Winnowing Machines.*

Canada	173 579	Grain separator.
	173 950	Threshing machine.
	174 118	Clover seed re-cleaning machine.
United Kingdom	17 650	Seed separator.
United States	1 217 299	Grain separator.

*Machines and Implements for the Preparation and Storage of Grain, Fodder, etc.*

Canada	174 093	Corn drier.
	174 108 — 174 172	Sheaf loaders.
United States	1 218 175	Hay-baler.
	1 218 448	Grain-grinding mill.
	1 219 020	Hay-loader.
	1 219 154	One-man hay-rack.

*Forestry.*

Canada	173 991	Timber felling machine.
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*Steering and Traction of Agricultural Machinery.*

Canada	173 921	Tractor.
United States	1 217 257	Implement-shifting means for tractors.
	1 217 284 — 1 217 293 — 1 218 388 — 1 219 444 — 1 219 930	Tractors.
	1 218 666	Transmission mechanism for tractors and the like.
	1 219 323	Tractor drive-wheel and mounting for same.

*Feeding and Housing of Livestock.*

Canada	173 632 — 173 727 — 173 807	Horseshoes.
United Kingdom	17 915	Process for recovery of albuminous products suitable for use as forage or manure from the waste water where fish, etc., is treated to obtain oil.
	103 556	Process for preparing food for animals from slaughter-house offal, etc.
United States	1 219 352	Hog-oiler.

*Aviculture.*

Canada	173 965	Brooder.
	174 088	Poultry feeding and watering device.
United Kingdom	18 079	Method of packing eggs, etc.
	103 797	Troughs for animals.
	104 143	Poultry-feeders.
United States	1 219 114	Automatic poultry-feeder.

*Industries depending on Plant Products.*

Italy	156 133	Must separator.
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*Dairying.*

Canada	173 756 — 173 875 — 173 876 — 173 877 — 173 878 — 173 879 — 173 880 — 173 881 — 173 882 — 174 090 — 174 147	Milking machines.
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	174 035	Process for pasteurizing milk.
United Kingdom	17 336 — 17 777 — 17 778	Milking machines.
United States	1 218 125 — 1 218 529 — 1 218 446	Milking machines.

*Farm Buildings.*

Canada	173 630	Cattle stall.
	173 640	Silo.
	174 214	Roof for silos, etc.

FARM  
BUILDINGS

582 - **Purifier for Rain-Water.** — GRANDERYE, L. M., in *La Vie agricole et rurale*, Year 7, No. 13, p. 227, 2 fig. Paris, March 31, 1917.

The simplicity, low price and easy construction of this new apparatus for purifying rain water make it of interest for all farms where rain water is used as drinking water.

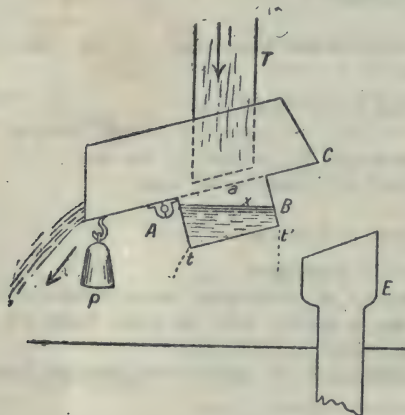
*Purifier for rain water.*

Fig. 1  
Trough in normal position.

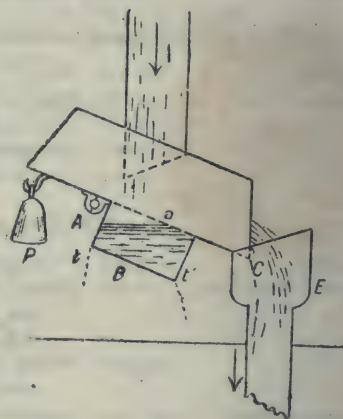


Fig. 2  
Trough when tipped.

It consists of a galvanised iron trough *C*, of square section, 40 cms. long, 12 cms. wide and high, pivoted on an axle *A*. A weight *P*, attached at the end nearest to *A*, keeps the trough in a slanting position. A parallelipedal box *B* is soldered on to *C* near to the axle *A*; it communicates with the trough by means of a number of holes *a* pierced in the bottom and has two very small holes *t* and *t'* for emptying. *T* is the pipe for the rain and *E* that leading into the cistern.

Normally, the trough is in the position shown in fig. 1. When there is rain, the water coming from the roof flows into the trough and escapes at the side *P*; but, as the water gradually filters through the holes *a* into the box *B*, at a certain moment the weight of water causes the trough to tip and the rain water, free from impurities, flows into the cistern by *E* (fig. 2).

The axle *A* is of iron, 10 to 20 mm. in diameter, and firmly fixed in the



wall. Two pins prevent the trough from moving either near to the wall or slipping off the axle. The tipping action should be easy.

The box *B* should contain about a litre; the number of holes *a* should be in inverse proportion to the area of the roof, for, the larger the roof, the longer it takes to wash it clean. Roughly speaking, the roof will be sufficiently clean when 1 to 2.5 mm. of rain have fallen, which is equal to from 1 to 1.5 litres per square meter.

The distance of the axle *A* from the weight *P* will equal  $\frac{1}{3}$  or  $\frac{1}{4}$  the distance from *A* to *C*. The weight *P* should be such that the box, filled with water up to the level *x*, should tip easily and that the box being empty or nearly so, it can return the apparatus to its original position, which takes place when the small holes *t* and *t'* have allowed the water to escape slowly.

After a fall of rain, the holes *a*, *t* and *t'* should be examined to see that they are not stopped up.

## RURAL ECONOMICS.

583 - **Methods and Cost of Growing Beef Cattle in the Corn Belt States.** — COTTON, J. S., COOPER, MORTON O., WARD, W. F. and RAY, S. H., in *U. S. Department of Agriculture, Office of the Secretary, Report No. III*, pp. 1-64. Washington, July 1, 1916.

This study represents Part III of an investigation into the production and consumption of meat organised by the Secretary of Agriculture (1). The data were collected from 595 farms representative of the agricultural situation in the Corn Belt, in the following states: — Illinois, Iowa, Missouri, South Dakota, Nebraska, Kansas, Minnesota and Indiana. Cattle-breeding is the most important branch of agriculture in this district, in Minnesota, 29 % of the total farm area is pasture, and in Indiana 65 %.

Table I summarises the data collected in each state concerning the size of the farms, their division into pasture, corn, small grain and hay, and their average value per acre.

The chief object of the investigation was to determine as accurately as possible the cost of producing beef animals. With this end in view the records were divided into 6 groups based on the 6 distinct practices followed in general by the farmers.

GROUP I (Beef). — *Farms where all the cows are kept strictly for beef (not including farms producing baby beef). On a number of these farms enough milk was taken from 2 of 3 of the best milkers to supply the family with milk and butter. In such instances the milk and butter credits have been ignored as it was found that the value of the extra labour in milking and caring for the calf, and of the extra grain given, usually offsets the value of these milk products.*

GROUP II (Baby Beef). — *Farms on which the breeding herds are*

(1) See *B. March 1917, No. 286.* (Ed.).

*maintained for the production of high-grade calves, which are fattened on the same farm and sold at from 12 to 18 months of age as baby beef.*

**GROUP III (Dual purpose).** — *Farms on which all the cows are milked, and either cream or butter sold, the calves being weaned at birth and raised on skim milk.*

**GROUP IV (Mixed).** — *Farms on which the best cows are milked, their calves being weaned at birth and fed skim milk. The calves from the other cows are allowed to run with their dams as in the beef group.*

**GROUP V (Partially milked).** — *Farms on which the calves are not weaned, but on which a part of the milk is drawn from the cow, the calf taking the remainder. There are a number of variations of this practice. One of these is to allow the calves to run with their dams during the day, but to keep them in a separate inclosure at night, the cows being milked in the morning. Another common practice is to keep the calves separate and allow them to take the bulk of the milk twice daily, the remainder being taken for household and market purposes.*

**GROUP VI (Double nursing).** — *Farms where some of the cows are milked and their calves given to other cows, the latter raising two calves each.*

**TABLE I. — The Average Size and Value of Farms Visited and the Percentage of Each in Pasture, Corn, Small Grain and Hay, by States.**

State	No. of farms	Average size of farms	Area in pasture		Area in corn		Area in small grain		Area in hay		Value of land
		acres	acres	%	acres	%	acres	%	acres	%	per acre
Indiana (1914) . .	23	294	191	65	43	15	16	5	25	9	\$59
Illinois (1914) . .	21	294	158	54	60	20	32	11	38	13	129
Minnesota (1914-15)	60	357	104	29	85	24	66	18	51	14	125
Iowa (1914-15) . .	219	301	93	31	85	29	54	18	38	13	175
Missouri (1914-15)	78	356	179	50	53	15	36	10	71	20	82
South Dakota (1914)	14	511	180	35	146	29	90	18	75	15	97
Nebraska (1914-15)	66	380	116	31	105	28	74	19	53	14	132
Kansas (1914-15) .	114	566	326	57	79	15	62	11	69	12	80

It may be seen that, in all these groups, animal production is based on the breeding herd, which remains almost constant. Table II shows the average importance of breeding cows in the 6 groups.

The cost of beef production was estimated by the following method: First of all the annual gross cost of maintaining each breeding cow and each bull was determined. The net profit was then estimated, including milk and manure, but excluding the calves. Next the percentage of baby beef in proportion to the number of cows and bulls was calculated. The net cost of the cows and bulls was divided in proportion to these percen-

TABLE II. — *The Size of the Herds in Each of the Different Groups.*

Group	Number of farms	Cows		Bulls	
		Total number	Average number	Total number	Average number
I . . . . .	230	7 246	31.50	255.5	1.11
II . . . . .	66	2 281	34.56	81	1.23
III . . . . .	110	1 403	12.75	103.25	0.94
IV . . . . .	102	2 394	23.47	101	0.99
V . . . . .	65	929	14.29	60.5	0.92
VI . . . . .	22	381	17.32	20	0.91
<i>General average.</i>	<b>595</b>	<b>14 634</b>	<b>24.55</b>	<b>621.25</b>	<b>1.04</b>

TABLE III. — *Average Gross Cost of keeping a Breeding Cow in the 6 Groups, and Net Cost.*

Groups	Number of farms	Number of cows	Average cost per cow.											Total net cost, including milk or butter and manure (excluding calves)
			Feed charges			Labour	Equipment	Interest	Risk	Taxes	Insurance (70 % of the farms)	Veterinary	Total gross cost	
			Summer	Winter	Entire year									
			\$	\$	\$	\$	\$	\$	\$	\$		\$	\$	\$
I	230	7 246	8.20	16.49	24.69	3.88	1.75	3.83	.43	.34	.06	.14	35.12	50.33
II	66	2 281	9.11	17.19	26.30	3.11	2.25	4.16	.43	.31	.10	.11	36.17	31.38
III	110	1 403	7.90	24.15	32.05	15.23	3.32	3.60	.43	.31	.07	.13	55.14	6.07
IV	102	2 394	7.43	20.30	27.73	9.03	2.37	3.90	.43	.32	.07	.10	43.95	19.23
V	65	929	8.08	17.97	26.05	9.84	2.23	3.59	.43	.40	.07	.14	42.75	21.32
VI	22	381	8.50	20.39	28.89	9.80	3.01	3.82	.43	.33	.05	.17	46.50	13.24

tages. The average cost of the calves until weaning time on the different groups of farms was thus obtained. In determining the cost of production for one year the following factors were taken into consideration: — food, labour, equipment, interest, risk, taxes, insurance and veterinary expenses. The costs thus obtained were compared with the inventory or sale values.

Table III gives data concerning the average gross cost of keeping cows in the 6 different groups, and the net and relative cost, including milk and manure, but excluding calves. In a similar way the cost of bulls was determined, and the cost of calves up to one year by the method described above.

Table IV summarises the results of these calculations as compared with the cost of production. In considering the records of the two years



TABLE IV. — Summary Table Showing for the 6 Groups the Various Factors that make up the cost of Producing a Yearling

Item	Group I	Group II	Group III	Group IV	Group V	Group VI
Number of farms . . . . .	230	66	110	102	65	22
Average number of cows per farm . . . . .	31.50	34.56	12.75	23.47	14.29	17.32
<i>Cost of maintaining the breeding herd:</i>						
Gross cost of maintaining a cow . . . . .	\$35.12	\$36.77	\$55.14	\$43.95	\$42.75	\$46.50
Credits other than cow . . . . .	4.79	5.39	49.07	24.72	21.43	33.26
Net cost of maintaining a cow . . . . .	30.33	31.38	6.07	19.23	21.32	13.24
Net cost of maintaining a bull . . . . .	42.27	53.26	37.51	46.79	34.14	40.53
<i>Calf crop:</i>						
Percentage of cows raising calves to weaning time . . . . .	84.9	90.7	83.9	87.5	90.1	92.1
Number of calves per bull . . . . .	20.9	25.3	10.7	18.5	12.6	15.0
<i>Cost of raising a calf to weaning time:</i>						
Cow charge . . . . .	35.47	34.50	7.34	22.29	23.71	14.53
Bull charge . . . . .	2.26	2.29	4.02	2.91	3.55	3.02
Feed, including pasture . . . . .	0.01	—	9.35	4.48	0.02	0.26
Labour . . . . .	—	—	2.56	1.11	—	0.01
Total cost at weaning time . . . . .	37.74	36.79	23.27	30.79	27.08	17.82
<i>Cost of raising a yearling:</i>						
Number of farms . . . . .	190	67	99	96	57	22
Average number of calves per farm . . . . .	24.43	30.20	10.57	18.46	11.16	14.23
Cost at weaning time . . . . .	38.20	37.01	23.64	30.61	26.39	17.82
Winter-feed cost . . . . .	12.32	35.02	9.93	12.01	12.21	10.24
Other charges . . . . .	4.62	6.02	4.92	4.72	4.66	3.86
Gross cost . . . . .	55.14	78.05	38.49	47.34	43.26	31.92
Credits (manure) . . . . .	1.60	7.53	1.89	1.48	1.54	1.67
Net cost at 1 year . . . . .	53.54	70.52	36.60	45.86	41.72	30.25

1914-1915, it should be noted that the rather low average is due to the unsatisfactory results of the first year, caused by drought. The data obtained indicate that the keeping of cattle for beef purposes alone is adapted to the more extensive types of farming, while the keeping of cattle primarily for beef purposes, but where an income is also obtained from milk products, is better adapted to the more intensive types of farming. When estimating the profits obtained by raising calves on corn belt farms the following facts must be taken into consideration: 1) Good returns have been obtained for a large quantity of roughage which would otherwise have been wasted; 2) a home market has been provided for saleable crops; 3) on many farms a large acreage suitable to pasture only has been utilised; 4) profitable employment is provided for a season of the year when labour otherwise might be idle; 5) a return is obtained for capital invested in equipment which, in many instances, were it not utilised by live stock, would return nothing; 6) the farmer makes at least 6 % interest on the money he has invested in the cattle business.

It should be noted that the greatest profits were yielded by Group VI, the double-nursing group. Although this system is adopted by a small number of breeders only and only 22 records were procured, it gave the lowest cost of production both for calves at the time of weaning and for yearlings. This result is largely due to the milk credits, which were obtained without extra labour other than milking. It is also due to a larger percentage of calves produced by the cows, and to a larger proportion of the records being taken in the more favourable year of 1915.

584 - The Economics of Live Stock Production in the Far Western Range States, U. S. A. — See No. 569 of this *Bulletin*.

## AGRICULTURAL INDUSTRIES.

585 - Fermentation Tests of Tea Leaves, in Java. — BOSSCHA, K. A. R. and BRZESOWSKY, A., in *Mededeelingen van het Proefstation voor Thee*, No. XLVII, 40 pp., 10 fig. + 1 pl. Buitenzorg, 1916.

INDUSTRIES  
DEPENDING  
ON PLANT  
PRODUCTS

The writers wished to clear up the controversial problems regarding the character of the fermentation of the leaves of the tea plant, necessary to obtain black tea.

Up to the present the fermentation was either attributed to the oxidising action of peroxidases on certain substances in the leaves, or to the development of certain microorganisms, particularly yeasts.

The writer found that the microorganisms found normally on freshly gathered tea leaves were species of Hyphomycetes belonging to the genera *Aspergillus*, *Penicillium*, *Mucor* and *Dematiium* — 1 species of yeast, — 3 species of bacteria, including a *Micrococcus*.

To ascertain the influences of these organisms on the fermentation, a method was first tried for sterilising the leaves without reducing them to such a state that fermentation was no longer possible. For this end, the

leaves were washed in hydrogen peroxide, chloroform and mercuric chloride. To control the results, the varying temperatures of an untreated and fermenting heap of leaves were taken, when it was found that the temperature rose to a maximum of about 35° C., after which it gradually decreased.

On examining the organisms on leaves sampled at various stages of the fermentation, it was found that, before the temperature attains its maximum, the yeasts preponderate amongst the microorganisms; at the same time the samples tested for taste, aroma and other qualities gave satisfactory results. But as soon as the temperature begins to drop, the bacteria begin to preponderate over the yeasts, and the quality of the tea becomes inferior. At a temperature still further from the maximum, the Hyphomycetes *Penicillium* and *Mucor* develop in mass and the tea made from these leaves has a disagreeable taste.

On repeating the experiment with the sterilised leaves, the writers first found a rise in temperature towards the maximum analogous to that found with unsterilised, fermenting leaves, but afterwards the temperature followed another curve and sometimes reached, after falling, a new maximum. The leaves either remained sterile or harboured microorganisms after a certain time. The taste of the tea made from a sample taken after the first maximum was unpleasant in every case.

Whilst admitting that their work has afforded no satisfactory explanation of all the problems of the fermentation, the writers have concluded that it is due to a change in composition of the leaf independent of the action of the microorganisms on the leaves (Dr STAUB had already come to the same conclusion from his work published in *Mededeelingen van het Proefstation voor Thee*, No. 18). The writers continued their researches by studying the formation of carbon dioxide during the fermentation and have found it both in leaves previously sterilised and in leaves fermenting in the ordinary way. They conclude that the microorganisms have nothing to do with the formation of carbon dioxide.

These researches demonstrate the importance of a plentiful supply of oxygen for fermenting leaves; it is, therefore, advisable to ventilate well the places where the leaves are stored.

It was also found that the critical temperature for a regular and uninterrupted fermentation of tea leaves lies between 43° and 43.5° C.; consequently tea cannot ferment in an atmosphere of steam at 100° C., contrarily to what MR. H. JENSEN had found for tobacco.

In any case, the microorganisms are of very slight or no importance in tea fermentation, as is shown by these researches.

586 - "**Leblebii**", a Food Made from the Chick Pea (*Cicer arietinum*), in the Eastern Balkans. — ZLATAROFF, AS. (Communication from the Laboratory of the University of Sophia), in *Zeitschrift für Untersuchung der Nahrungs-und-Genussmittel*, Vol. 33, No. 3, pp. 107-112. Münster i. W., February 1, 1917.

"**Leblebii**", chiefly made in Bulgaria and Turkey, is much appreciated as a food and for making pastry ("chalva", "rachat-lukum", "cheker", etc.), which is also used in popular remedies. Roasted "**leblebii**" is also



TABLE I. *Comparative Chemical Composition of the chick pea and "leblebii".*

Substance analysed		Water	Fatty matter	Crude protein	Pure protein	Starch	Crude cellulose	Ash	P <sub>2</sub> O <sub>5</sub>
Chick pea. . . . .	No. 1	10.60%	4.79%	23.22%	21.16%	52.61%	3.40%	2.85%	0.89%
	No. 2	10.41	4.93	23.03	20.82	52.17	3.66	2.60	0.84
Leblebii. . . . .	No. 1	5.70	5.10	24.84	—	55.94	2.41	2.70	0.95
	No. 2	5.43	5.31	24.68	—	55.70	2.23	2.41	0.91

TABLE II. — *Physical Constants of the fatty matter extracted from the chick pea and "leblebii".*

Constants	Fatty matter extracted	
	from the chick pea	from "leblebii"
Specific gravity (15° C) . . . . .	0.9364	0.9283
Refractive index at 25° C . . . . .	74	72.5
Saponification index . . . . .	240	196.2
Acid index. . . . .	0.7	2.3
Ether index . . . . .	239.3	193.9
REICHERT-MEISSL number . . . . .	4.3	3.7
POLENSKE number . . . . .	1.6	5.2
HEHNER number . . . . .	90.07	89.19
Iodine index. . . . .	129	120
Non saponifiable substances . . . . .	0.49	0.48
Liquefaction point of fatty acids . . . . .	25° C	25.4° C
Iodine index of fatty acids . . . . .	146	136
Phosphatides (like lecithin) . . . . .	2.12 %	12.6 %

TABLE III. — *Composition of the ash of "leblebii".*

Ferrous oxide. . . . .	2.42 %	P <sub>2</sub> O <sub>5</sub> . . . . .	34.16 % (WOY method)
Lime. . . . .	9.09		36.48 (NEUMANN method)
Magnesium . . . . .	18.80	SO <sub>3</sub> . . . . .	3.09
Potassium . . . . .	26.01	SiO <sub>2</sub> . . . . .	0.40
Sodium. . . . .	3.10	Chlorine . . . . .	1.68

used by the poor people as a substitute for coffee, and, commercially, for adulterating ground coffee.

PREPARATION. — The chick peas are first separated into the different sizes by screening through leather or gut riddles, then the various grades are roasted separately, for about half an hour, on special open ovens, the chick peas being constantly stirred with a stick; the roasting is considered suffi-

cient when the peas are tender. They are then placed in sacks where they are left, at the ordinary temperature, until they have returned to their original state of hardness, which requires from 24 to 48 hours. Then a second roasting, or "naotlama" is carried out, after which the product is stored for at least a month, when they are packed, in quantities of 30 to 40 kilos, in wooden tubs containing sufficient non-calcareous river water just to swell the peas and prevent their looking dry on the surface. The more time that elapses between the first and second roasting, the less water the peas absorb, the resulting quality of the "leblebii" being improved.

The swollen peas are then roasted a third time, in smaller quantities than before, but so arranged that the roasting is all done in 6 hours. The peas should be stirred continuously and their appearance noted: they turn a yellow-grey colour and the tegument becomes brittle, which makes it easy to remove and taste the product at intervals until the required taste and consistency are obtained. Then the commercial "leblebii" is obtained ready for sale. Before the war, it cost **from 60 to 80 centimes the kilo.**

**CHEMICAL COMPOSITION.** — Table I, which gives the composition of both "leblebii" and the chick pea, shows that the roasting has decreased the water content and the percentage of crude cellulose in the former.

Table II, which gives the physical and chemical properties of the fatty matter extracted by ether from the chick pea, and "leblebii", shows that the change from the first to the second has decreased the iodine index and increased the acid index. The increase in the content of phosphatides (lecithin) is also characteristic.

The writer also determined the changes undergone by the carbohydrates in the preparation of "leblebii". Analyses made by the GERBER & RADENHAUSEN method showed that 20 % of the starch of the chick pea is changed into soluble detrin.

Table III shows the composition of the ash of "leblebii". While the chick pea is very hard and difficult to chew, "leblebii" presents no such difficulty; it has a sweetish taste and differs from the nuts used as food in Europe by its lower fat content; it is probably more digestible than the nuts. "Leblebii" is very useful in feeding children over 6 months old, especially when they have intestinal troubles.

587 - **Changes in Fresh Beef During Cold Storage Above Freezing.** — HAGLAND, R., MCBRYDE, CH. N., and POWICK, W. C., in *U. S. Department of Agriculture, Bulletin* 433 (Professional Paper), pp. 1-100. Washington, February 15, 1917,

There are two general methods of handling fresh beef in cold storage :

1) storage at temperatures above freezing, usually between 32° and 38° F., and 2) storage at temperatures below freezing, usually between 8° and 12° F. According to HOLMES (1913), 3.1 per cent. of the beef slaughtered commercially in the United States in 1909 was placed in cold storage at temperatures below freezing (frozen beef); 96.9 per cent was stored at temperatures above freezing (chilled beef).

This discussion only concerns chilled beef, and the methods by which it is handled in the larger meat-packing establishments of the United States.

It was undertaken with the following objects in view: 1) To study the changes which take place in fresh beef stored at temperatures above freezing, with special reference to the effect of such changes upon the wholesomeness of the product; 2) to determine the causes of the changes which take place in fresh beef held in cold storage under the above conditions; 3) to determine the length of time that fresh beef can be held in cold storage at temperatures above freezing and remain in wholesome condition, with special reference to the effect of various factors upon the length of the storage period.

For the purpose of studying the problems outlined above, three distinct lines of investigation were planned: 1) autolysis experiments with fresh beef; 2) cold storage experiments with fresh beef; 3) a study of the factors affecting the length of time that fresh beef can be carried in cold storage.

The changes which ordinarily take place in fresh beef and in other meats as well, during cold storage at temperatures above freezing, may be due to one or more causes: 1) enzymes occurring naturally in the meats, 2) bacteria, and 3) chemical and physical agencies.

The action of the first of these agencies is probably less well understood than is that of the two others, and seemed to call for special investigation.

*Results of Autolysis Experiments.* — The results of the autolysis (1) experiments reported in this paper may be summarised as follows: Physical changes in the samples of muscular tissue were not marked, even at the conclusion of the experiment and consisted chiefly of a slight softening of the tissues, and exudation of meat juice, and a change in colour of the meat.

Incubated samples developed a characteristic, rather pleasant odour similar to that of roast beef the odour becoming more pronounced as the period of incubation progressed. A sample which had been incubated 103 days did not prove to be a palatable food for human consumption.

Total soluble extract or total solids showed a decrease early in the experiment and later an increase, the total increase amounting to 8.77 per cent. of the amount present in the fresh material. Ash of extract showed appreciable, but not regular, increases, which correspond roughly with similar increases in total soluble phosphorus.

The acidity of the samples showed appreciable increases, particularly toward the close of the experiment.

The changes which took place in the nitrogenous compounds consisted in general in an increase in total soluble nitrogen and in a conversion of the higher forms of soluble nitrogenous compounds into simpler combinations. Coagulable nitrogen showed a marked decrease, more than 50 per cent. of which took place during the first week of the experiment. The total decrease amounted to approximately 80 per cent of the amount present in the fresh material. Non-coagulable nitrogen increased fairly

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(1) The discovery of autolysis is generally accredited to SALKOWSKI (1891) who called the process "autodigestion".



regularly during the course of the experiment, the total increase amounting to 173.8 per cent. Proteose nitrogen increased rapidly early in the experiment and the quantity then remained practically stationary during the remainder of the incubation period. Amino-nitrogen showed greater actual and relative changes than any other nitrogenous constituent, this constituent representing in large degree an accumulation of the end-products of proteolysis. The total increase in amino-nitrogen amounted to 740 per cent and nearly one-fourth of the total nitrogen was in the amino form at the end of the experiment.

Phosphorus compounds showed changes which consisted chiefly in appreciable increase in total soluble phosphorus and in soluble inorganic phosphorus, and in corresponding decreases in insoluble and insoluble organic phosphorus. Insoluble phosphorus decreased rapidly early in the experiment and more slowly and fairly regularly during the remainder of the period, the total decrease amounting to 91.29 per cent. of the amount present in the fresh material as calculated from the ratios of insoluble total phosphorus. Total soluble phosphorus showed increases corresponding to the decreases in insoluble phosphorus, the total increase amounting to 23.05 per cent, as calculated from the ratios of total soluble phosphorus to total phosphorus. Soluble inorganic phosphorus increased rapidly early in the experiment, and more slowly towards the close, the total increase amounting to 65.27 per cent., as calculated from the distribution figures. Soluble organic phosphorus showed decreases corresponding to the increases in soluble inorganic phosphorus, the total decrease amounting to 75.95 per cent., as calculated from the organic phosphorus ratios.

There was no development of free hydrogen sulphide during the course of the experiment.

#### *Results of cold-storage experiments with fresh beef.*

The chemical changes which took place in the muscular tissue of beef in cold storage, at temperatures above freezing for periods ranging from 14 to 177 days, consisted chiefly in increases in acidity; in proteose non-coagulable, amino and ammoniacal nitrogen; and in soluble inorganic phosphorus; while decreases occurred in coagulable nitrogen and in soluble organic phosphorus. On the whole these changes were of a progressive nature.

The chemical changes that took place in the fatty tissues of the beef consisted chiefly in marked increases in the acidity of the kidney, and external fats.

On the whole the chemical changes which took place in the muscular tissue of the beef during storage were similar in nature to, but less in extent, than those that were caused by enzymatic action, when lean beef was autolysed under aseptic conditions for periods ranging from 7 to 100 days.

The chemical changes which took place in the muscular tissue of the beef during storage were without appreciable effect either upon the nutritive value or the wholesomeness of the edible portions of the product;

but the changes which took place in the kidney fat and external fatty tissue after the longer periods of storage rendered them unsuitable for human consumption.

The bacteria and moulds which grew on the surface of the cold-stored meats did not penetrate the muscular tissue to any great depth. The increased tenderness noticed in the cold-stored meats could not be attributed to bacterial action; and no noticeable change in the histological structure of the muscle fibres was noticed after 11 weeks of storage.

The chemical changes which took place in the muscular tissues of the beef during storage may be regarded as largely due to enzyme action.

The principal effect of storage upon the organoleptic properties of the beef was a marked increase in tenderness of the meat. This change did not appear to progress appreciably after the beef had been held in storage for from two to four weeks. While the flavour also changed, individuals would probably not agree as to whether the change was an improvement or a deterioration.

Beef was held in cold storage at temperatures above freezing in an experimental cooler for as long as 177 days, whereas it was possible to hold beef in storage in a cooler in a modern packing-house for only 55 days. The shorter storage period in the second instance was due to the much higher humidity of the packing-house cooler, as compared with the experimental cooler.

The length of time that fresh beef can be held in cold storage at temperatures above freezing and remain in wholesome condition, is dependent upon a number of factors, among which the temperature and humidity of the storage room and the character of the beef are the most important.

588 - **Investigations into the Changes undergone by Eggs.** -- LINDET, in *Comptes rendus des Séances de l'Académie d'Agriculture de France*, Vol. III, No. 11, pp. 320-329. Paris, March 21, 1917.

This paper is a summary of a report presented to the Public Health Department at the request of the Prefect of Police of the Seine Department. It contains the results of experiments made in collaboration with M. HUSSON, tutor at the National Agricultural School of Grignon.

In order to measure the extent of the change, account was taken of: 1) the amount of albuminoid peptonised by the bacteria, which, consequently, is not coagulated by heat, or even precipitated by alcohol of a given concentration; 2) the amount of ammoniacal nitrogen produced by bacterial fermentation.

Eggs may be attacked by bacteria (bacilli and cocci) (1) and by moulds.

Among the bacteria may be mentioned: *Bacterium coli*, even the typhoid and paratyphoid bacilli; *B. subtilis*, *B. pyocyaneus*, *B. liquefaciens fluorescens* and *B. liq. non fluorescens*; *Pasteurella*, *Sarcinae*; *Bacterium termo*, *Bacterium putridum* Flügge; cocci, including *prodigiosus*, *Staphylococcus albus* and *aureus*, etc.

(1) See also: *B.* 1916, Nos. 334 and 1025.

(Ed.).



Among the rarer fungi are : *Penicillium glaucum* and *Sterigmatocystis*.

In experiments on 2510 eggs from 65 hens, MR. CALDWELL, Director of the Rhode Island Agricultural Station, found bacteria in only 228 (8.8%). In each case the yolk only was attacked, the white being immune. It may, therefore, be assumed that an egg which contains bacteria, has been infected within the ovary, where the yolk forms, rather than in the oviduct, where it is covered with albumin.

Since all eggs go bad in due course, there can be no doubt that the bacteria can penetrate the shell and its membranes. Infection is not very rapid, especially in the white of the egg, as the mucous liquids do not form a good medium for the growth of bacteria. In time the white, and more particularly the yellow, liquefy during peptonisation under the influence of the proteolytic diastases secreted by the bacteria ; when held to the light the yellow may be seen, first floating on the white, then mixing with it.

The author followed this progressive change by the estimation of the ammoniacal nitrogen in the presence of magnesia. At the beginning there was an average of 0.010 gr. of ammoniacal nitrogen per 100 gr. of eggs. After 6 weeks' incubation at 28 to 30° the percentage was 0.021, or even 0.024 %. The same figures were obtained for both fertile and unfertile eggs.

Hard eggs change more rapidly than fresh eggs. In order to study this phenomenon the ammoniacal nitrogen was estimated in a batch of new-laid eggs, half of which were left raw and the other half boiled for a quarter of an hour. These eggs were then kept at a temperature of from 28 to 30° for equal lengths of time, the last being of 50 days' duration. Samples were taken from time to time. Whereas the ammoniacal nitrogen content of raw eggs was 0.024 gr., that of boiled eggs was 0.107 gr., that is to say, 4 times as great. The peptonised nitric matter rose from 0.66 to 0.91 % in the raw eggs, and to 1.36 % in the boiled eggs.

The more rapid change of boiled eggs as compared with that of raw eggs is due to the following causes : 1) boiling renders the shell membranes more permeable to gas, fluids and bacteria ; 2) boiled white of egg is no longer a viscous mass, but is composed of particles of coagulated albumin which form a favourable medium for the growth of microorganisms. The estimation of the ammonia proved that, whereas, in raw eggs of different ages, the yellow contains more ammonia than the white, the contrary is true of boiled eggs, in which the ammonia in the white finally exceeds that in the yolk in the ratio of 150 to 100.

Moulds may enter the egg during its passage through the oviduct, and, though larger than bacteria, they may penetrate the shell. This has been proved experimentally. Within the egg, the mycelium forms so-called "damp spots" (because they appear when the egg is left on damp straw). The fungi which cause the stains form a mass of mycelium and spores. The base of the mycelium is fixed either to the inner shell membrane or between two membranes, but not on the shell. These mycelium are either pale yellow, greenish black or a fine pink. The yolk often adheres, not to the



shell, but to the mycelium, which fastens on to it and displaces it. In hard-boiled eggs only the yolk seems to be displaced as the viscous mass of the mycelium is coagulated.

The estimation of the ammoniacal nitrogen throws little light on the change produced by the stain, because moulds have but a weak power of forming peptone or ammonia.

The moulds which form the stains are identical with those found on fruit and cheese. The bacteria may prove harmful, and eggs attacked by them should not on any account be used for human consumption.

589 - The Maintenance of Atmospheric Humidity in Citrus Storage Rooms. —

See No. 580 of this *Bulletin*.

## PLANT DISEASES

### DISEASES DUE TO FUNGI, BACTERIA AND OTHER LOWER PLANTS.

#### GENERALITIES.

590 - Root Diseases Due to *Rosellinia* sp. in the Lesser Antilles. — NOWELL, W. in *West Indian Bulletin*, Vol. XVI, No. 1, pp. 31-71, Fig. 1-12. Bridgetown, Barbados, 1916.

Several species of the genus *Rosellinia* give rise to a well defined type of root disease in numerous countries of the world, both temperate and tropical. The fungus kills cultivated trees and shrubs, and often infests the soil and destroys practically all vegetation with which it comes into contact.

In the Lesser Antilles, *Rosellinia* diseases occur in Guadeloupe, Dominica, Martinique, St. Lucia, St. Vincent, and Grenada; they are unknown in the remaining islands of the group which have drier climates.

The range of hosts is exceedingly large including practically all the important cultivated and semi-cultivated plants, but the crops most affected are those of cacao (in all the islands), coffee (in Guadeloupe and Martinique), limes (on new clearings in Dominica) and arrowroot (in the interior districts of St. Vincent).

The disease on cacao is usually caused by the species *Rosellinia pepo*, and in most cases at the present time, the fields being well established, is transmitted from the dead, or dying, shade trees, especially by *Artocarpus incisa*, *Persea gratissima*, and *Inga*. Another species, as yet unidentified, is believed to attack cacao in certain localities.

The disease on limes and coffee is caused by *R. pepo* or *R. bunodes* indifferently.

The first cases in new clearings are generally associated with decaying tree stumps, especially those of certain special trees. Subsequent cases arise from the spread of the fungus from tree to tree along the roots, or by infection from surface soil rich in decaying vegetable matter, which readily becomes infected in damp and shaded situations.

An infested tree may be killed gradually by the progressive investment of the roots, or rather quickly by the destruction of the bark around the collar. The fungus penetrates both bark and wood. Conidia are produced with great readiness wherever the mycelium emerges into the

open; perithecia occur later, and especially in the case of *R. pepo*, their formation may be much delayed.

Much can be done to prevent outbreaks of the disease by measures directed towards exposing the soil, the bases of the trees and any dead material lying about to wind and sun. This should also be done at the first signs of the disease which, however, are not easily recognised, though regular inspection may save many trees.

Infested trees should be flamed and then promptly removed, all roots dug out and burnt, the soil limed, and the place exposed as much as possible. All adjacent trees should be isolated from each other by trenches.

591 — **Wheat Varieties Resistant to Rust in the Province of Rovigo, Italy.** — See No. 541 of this *Bulletin*.

RESISTANT  
PLANTS

592 — **Disease Resisting Varieties of Potato, in Germany.** — See No. 542 of this *Bulletin*.

593 — **Disease Resisting Sea Island Cottons, in the United States.** — See No. 536 of this *Bulletin*.

594 — **Silver Nucleinate, a Substitute for Copper Sulphate in the Control of Vine Mildew.** — VON DEGEN, A., in *Allgemeine Wein-Zeitung*, Year 34, No. 4, pp. 25-28. Vienna, January 25, 1917.

MEANS  
OF PREVENTION  
AND CONTROL

The writer, who is the director of the Ampelological Institute at Budapest, has carried out a series of experiments in order to find substitutes for copper sulphate in the control of *Plasmopara viticola*. Amongst other remedies, silver salts were tried. Silver nitrate was eliminated because it decomposes easily under the influence of light and air.

Exhaustive experiments, however, were made with silver nucleinate. This is a characteristic combination where the silver is very loosely combined with nucleinic acid; it splits off from the acid more easily than in true colloidal compounds, such as "collargol", "albargine", and "protargol".

At the request of the "Chinoinfabrik" of Kereszty and Wolf at Ujpest-Budapest, GUSTAVE FRIEDL prepared in 1915 for the first time, silver nucleinate; this manufactory had placed some material at the disposal of the writer for the purpose of the tests. The material was delivered as a dried preparation consisting of small, greenish-black plates with a metallic lustre and completely soluble in water, giving a brownish, opaque solution. The product should keep perfectly, but the writer thinks that the aqueous solution can only be kept when protected from light. The preparation of the dry product adds considerably to its cost price, therefore, the writer advises the purchase of the cheaper solutions of 30-50 % strength.

The tests were carried out on two plots, one of which contained 28 "Italian Riesling" vine-plants, while the other contained 28 "white Sauvignon" vines. One plot was treated with a 0.5 % solution of nucleinate, the other with a 0.1 % solution. All the plants were treated five times: May 29, June 14, July 1 and 24, August 5.

The 0.5 % solution gave excellent results. During the summer, the plants on that plot had much greener foliage than those on the other;



their yield in grapes was excellent. The leaves developed in spring remained attached to the plant till the end of autumn, whilst on plants treated with other remedies or on control plots, the leaves had either all fallen by the end of autumn or only the last formed leaves remained.

The dark green colour of the leaves treated with nucleinate is due to small spots formed by the precipitation of metallic silver on the leaf. The tissue under these spots was partly destroyed. The writer intends to enquire into the subject of these spots more closely; but, according to chemists, it is certain that they are not caused by an acid.

The remedy adheres well to the leaves and the spots do not interfere with the functions of the leaf; the unspotted part of the leaf, which formed the larger part, seemed amply sufficient to keep the leaf alive as well as to supply the grapes with the necessary food substances.

The discoloration and fall of the leaves in autumn took place much later in nucleinate treated plants than in others; a large proportion of the leaves were still attached to the plant on November 7, which, from the physiological point of view, was rather a disadvantage.

The 0.1 % solution was too weak to protect the vines sufficiently against infection. Here again, there were black spots on the leaves, but mildew might have been the cause. The leaves remained attached to the plant till the middle of November.

This work refers to an attack by *Plasmopara* of medium strength, an attack where the untreated plants had lost all their leaves and where all the grapes were already destroyed by June. The foliage of vines treated with other remedies was, in part, equally destroyed.

How the remedy would act with a more intense attack cannot be safely said, but it is quite certain that the nucleinate is a poison to *Plasmopara*.

The practical use of the remedy is difficult on account of the high price — 45 crowns per kilogram of the dry product. As copper sulphate is now dearer in Austria-Hungary, it may be admitted that, in certain cases, the use of silver nucleinate would be more economical.

595 — **The Influence on Germination of the Hot Water Treatment of Cereal Seeds for Smut.** — See No. 533 of this *Bulletin*.

596 — **Patents Relating to the Control of Plant Diseases and Pests.** — See No. 581 of this *Bulletin*.

597 — **On the Appearance of *Puccinia glumarum* (Yellow Rust) on Wheat in 1914 and 1916 in Germany.** — MÜLLER, H. and MOLZ, E. (Communication from the Phytopathological Station at Halle a. S.), in *Fühling's landwirtschaftliche Zeitung*, Year 66, Part 2, pp. 42-45. Stuttgart, January 15, 1917.

On account of the several attacks of the yellow rust of cereals on wheat in April and May, 1916, the writers sent a series of questions to the farmers in the phytopathological district of Halle, in order to determine the amount of damage caused by the rust. A similar series had already been distributed in 1914. The comparison of the two series of replies allows the writers to draw the following conclusions.

1) The appearance of the yellow rust is favoured by difficult growth

of the wheat plant; in 1914 and 1916, growth had suffered from drought and very cold nights; this abnormal conditions had also favoured the germination of the uredospores.

2) The various varieties of winter wheat behave differently with regard to the rust; early varieties are more liable to the disease than late ones; Rivetts Bearded wheat was very resistant, and the variety "Criewener 104" was fairly resistant to rust; Squarehead wheats were very liable to it.

3) As regards the influence of manuring on the advent of the fungus, the question is not yet decided, especially for the nitrogen; it is certain that potash and phosphoric acid increase the resistance.

4) On heavy, deep and damp soils, less damage was caused than on shallow dry soils. Rust was never found on marshy soils, rich in mineral matter; whilst on soils poor in food stuffs (especially in the upper trias and the shelly limestones) it appears in mass; however, the writers are not in a position to generalise on these observations.

5) The best crop to precede wheat in the rotation was found to be sugar-beet: by mellowing the soil and improving the water content, it renders difficult the appearance of rust; cereals (specially oats) and sometimes lucerne, which require a large water supply and thus leave the soil already dry for the wheat, are less suitable for preceding wheat in the rotation.

6) Late sown wheat (end of October, beginning of November) were little subject to rust, but this cannot be generally applied.

7) The presence of meadows and watercourses near the wheat fields have had a favourable influence on the appearance of rust.

598 - *Cystospora batata* n. g. and n. sp. the Cause of "Soil Rot" or "Pox" in *Ipomoea* (*Batatas*). — ELLIOT, JOHN, A., in *Science*, New Series, Vol. XLIV, No. 1142, pp. 709-710. Lancaster Pa. November, 1916.

In 1891, HALSTEAD published the results of his study of the "soil rot" of sweet potatoes which he ascribed to the fungus *Acrocystis Batatus*.

The writer describes in the present preliminary note observations made by him in 1916 at Delaware (United States) which led to the discovery that the disease is due to a plasmodium, and that there are 2 modes of infection. One is by the plasmodium, as a whole, causing large shallow pits; the second is by means of swarm spores; these are developed within the thick walled cyst formed by the plasmodium.

The swarm spores entered the growing points of the roots causing a pit or "pox" scar on reaching the main root. A secondary infection by swarm spores causing blister-like elevations in the skin of stored sweet potatoes has also been observed. Ordinary potatoes are also subject to the disease.

The formation of a thick-walled cyst containing several hundred swarm spores distinguishes this plasmodium from the known genera of *Plasmodiophorales*, accordingly, the name *Cystospora batata* gen. nov. sp. is proposed for this new organism.

599 - Diseases of the Sweet Potato in the United States. — See No. 543 of this Bulletin.



- 600 - *Choanephora Cucurbitarum*, a Phycomycete Parasitic on *Cucurbita* spp. in North Carolina, United States of America. — WOLF, FREDERIC A., in *Journal of Agricultural Research*, Vol. VIII, No. 9, pp. 319-327, Pl. 85-87. Washington, D. C. February 20, 1917.

During the summer of 1916, various species of *Cucurbita* in the vicinity of West Raleigh, North Carolina, were attacked by a phycomycetous fungus, *Choanephora Cucurbitarum* (Berk. and Rav.) Thaxter. This parasite was also observed in two other localities within the State — Winston-Salem and Walnut Cove. Since these points are rather widely separated, it is believed that *Choanephora Cucurbitarum* is generally present throughout the State. Further, from different reports received, there seems to be no doubt that the disease occurred during 1916 in other southern States.

The fungus in question has done great damage, causing a blight of the flowers and a rot of the fruits. Not only did it attack *Cucurbita Pepo*, but was also found on the fading flowers of *Cucumis sativa*, *Hibiscus syriacus*, *Hibiscus coccineus*, *Hibiscus esculentus* and *Gossypium herbaceum*.

The occurrence of *C. cucurbitarum* on *Cucurbita* spp., *Hibiscus* spp., and other plants had been previously reported. It however, appears to be parasitic only upon *Cucurbita*. The fruits are usually infected by the passage of the fungus from the fading corolla to the young fruit. The spores of the parasite, which is the only known American species of the genus *Choanephora* are disseminated by the wind and by various insects. The conidial stage alone appears on affected parts of the several host plants. The sporangia, chlamydospore and zygosporangium stages have been produced in artificial culture. None of these stages have previously been reported by investigators within the United States. All of the reproductive stages have been noted in the same culture on agar. Conidia, sporangia and zygosporangia may mature in cultures 24 to 48 hours old.

- 601 - The Discovery of Teleutospore Sori of *Cronartium Ribicola* in the Interior of the Petioles of *Ribes Roezli*. — COLLEY, REGINALD, H., in *Journal of Agriculture*, Vol. VIII, No. 9, pp. 329-333. Pl. 88, Washington, D. C. February 26, 1917.

A review of the scientific literature dealing with the *Uredineae*, shows that the pycnidium, oecidium, uredospore and teleutospore stages have all been found inside the tissue of the host plant. The spores produced are apparently quite normal, and fill the intercellular spaces, or force aside the softer tissue of the surrounding parenchymatous cells.

The writer here records for the first time that *Cronartium Ribicola* Fisher also forms internal, teleutospore sori. He observed the formation of teleutospores in the interior of the petioles of *Ribes Roezli* (Regel) Caville and Britton, where they occurred chiefly in the pith and pericycle zone.

The writer thinks internal sori should be regarded as rather common teratological phenomena.

- 602 - A Disease of the Bulbs of *Narcissus* and of Other Plants in New South Wales, Australia. — DARNELL-SMITH, G. P., in *The Agricultural Gazette of New South Wales*, Vol. XXVIII, Part 2, pp. 141-142. Sydney, February 1917.

The writer has frequently had occasion to examine diseased bulbs of *Narcissus* and other plants which usually showed healthy internal and



external bulb scales, while the intermediate ones were brown and decayed, the decay starting near the apex and travelling downwards. Less often, the internal or external bulb scales were discoloured and diseased and, in the latter case, easily broke away at their base. As in the case of all decay, numerous bacteria were present.

Several fungi were isolated from the diseased bulbs, but investigation led to the view that they were not the primary cause of the disease.

The following explanation of the origin of the disease appears to the writer to be the most feasible. The reserve food material in a bulb is for the most part in the form of starch, which, during the growth of the bulb, whether the latter is throwing out new leaves at the commencement of the season, or forming a new bulb at the end of the season, is in a state of flux, much of it then being in the form of sugar.

When a bulb is lifted from the ground too early, before the foliage leaves have completely died off, the bulb scales contain a large amount of this sugar. At this stage the bulb appears to be peculiarly liable to the attacks of fungi, and receiving a check through severance from its root system, easily falls a prey to them. Even after the foliage leaves have died down, the bulb requires several weeks to mature and to become really ready for lifting.

On some of the foliage leaves of the daffodils examined, the writer found numerous little yellowish tuberosities occupied by nematodes; occasionally a whole bulb was found infested with eel-worms, possibly of a different species. The injury caused by these worms appears to be distinct from the rotting of the bulb-scales described above.

The writer advises those who have found their bulbs to be suffering from the rotting disease, to allow them to become mature by leaving them in the ground for about 3 weeks after the foliage leaves have completely withered.

Although Mr. DARNELL-SMITH had no occasion to examine hyacinth bulbs, he observes that the disease described by SORAUER under the name of "A Ring Disease of Hyacinth Bulbs" corresponds closely in character with the disease of daffodil bulbs studied by him. He gives a translation of Sorauer's article, from which it appears, among other things, that all the diseased portions of the bulbs were covered with *Penicillium*, which in this case behaved as a true parasite.

603 - *Helicosporium Nymphaearum* n. sp., a Hyphomycete Parasitic on *Nymphaea* in the United States. — RAND, FREDRICK, V., in *Journal of Agricultural Research*, Vol. VIII, No. 6, pp. 219-232, Plates 67-70. Washington, D. C., 1917.

About the middle of May, 1913, the attention of the Washington Laboratory of Plant Pathology was drawn to an irregular spotting and decaying of leaves of pond lilies (*Nymphaea* spp.) in the water gardens of Kenilworth, D. C.

On account of the severity of the disease in this particular locality and season, the present study was undertaken primarily to test the efficacy of spraying the floating leaves of a water plant with ordinary fungicides. The fungus causing the disease proved so interesting, however, that consider-

able time has also been devoted to the study of its characters and relation to the host.

A fungus belonging to the genus *Helicosporium* has been isolated from the olive-black, water-soaked spots on leaves of *Nymphaea* collected at Kenilworth D. C. and also at Arlington N. J., New York and Brooklyn N. Y.

The parasitism of this fungus has been demonstrated by successful inoculations made during 3 consecutive years on 9 species of *Nymphaea* (*N. odorata*, *C. caerulea*, *N. tuberosa*, *N. Daubeniana*, *N. zanzibariensis*, *N. Omarana*, *N. rubia*, *N. dentata*, *N. capensis*).

Hitherto, so far as has been ascertained, no data upon this disease have been published and the causal fungus is described as a new species under the name of *Helicosporium Nymphaearum*.

The fungus gains entrance to the host most readily through the stomata, which occur only on the upper leaf surface. Sections of infected leaves show the mycelium ramifying through the intercellular spaces and occasionally between cells which have become separated.

Many of the cells of the epidermis and parenchyma become filled with coagulation products, and the nuclei and chlorophyll bodies disintegrate.

In the older spots, the tissues are seen to have more or less completely collapsed and fungus hyphae are seen ramifying both between and within the decaying cells together with bacteria and various protozoa, a condition to be expected in a decaying mass of cells floating on a watery medium. The sclerotia and multiseptate conidia are developed sparingly on the diseased leaves and rather abundantly on many of the common culture media.

During the spring and summer of 1913, spraying experiments with ordinary Bordeaux mixture and with soda-Bordeaux mixture were carried out at Kenilworth. The disease had gained a considerable start before the work was undertaken; hence, its control was not as complete as it might otherwise have been. However, as shown by a careful comparison of sprayed and unsprayed plots, the leaves sprayed with Bordeaux mixture were clearly 50 per cent less injured by the disease than were the unsprayed leaves. The control by the soda-Bordeaux mixture was almost as high, but in this case, a slight spray injury to the leaves was observed. During the 2 following seasons, this treatment was continued by the owner on a commercial scale with satisfactory results.

604 - *Xylaria* sp., the Cause of Root-Rot of the Apple in Virginia, United States of America. — FROMME, F. D., and THOMAS, H. E., in *Science*, New Series, Vol. XLV, No. 1152, p. 93. Lancaster, Pa., January 1917.

An unusually destructive rot of the roots of apple trees is prevalent in the chief orchard sections of Virginia.

The symptoms of this disease have been known for some time, but the causal organism has not been determined.

Isolations made by the writers from diseased roots from a number of orchards in the State have yielded cultures of an imperfect fungus which appears to be the conidial form of a species of *Xylaria*. Inoculations made from pure cultures of these isolations into bark wounds of living apple trees in both damp chambers and in the field, have produced typical rotting of



the bark and wood, and the introduced fungus has been obtained in pure culture from the margin of these infected portions.

Recently, perithecial stromata of *Xylaria polymorpha* (Pers.) Grev. have been found on roots of apple trees in various stages of typical root-rot attack and on the stumps of several deciduous trees in a small patch of woodland immediately adjoining the orchard in question. Cultures obtained from germinated ascospores of this fungus are being used for additional inoculations into apple roots.

Pending the result of these inoculations, it seems reasonably certain that more than one species of *Xylaria* are involved, since certain cultural distinctions exist between some of the isolations; these, however, may, be varietal rather than specific.

Apparently all varieties of the apple tree are susceptible and probably equally so.

## WEEDS AND PARASITIC FLOWERING PLANTS.

605 - ***Plantago Psyllium*, a New Weed in South Australia.** — OSBORN, T. G. B., in *The Journal of the Department of Agriculture of South Australia*, Vol. XX, No. 5, pp. 260-362, 1 fig. Adelaide, December 1916.

*Plantago psyllium* L. (flea-seed) is one of the most recent additions to the alien weed flora of South Australia. The plant was sent for identification to the Agricultural Bureau of Nantawarra at the end of October 1916 together with the information that it was spreading rapidly in the district. Since it is likely that the weed will continue to spread, particularly in sandy districts — unless precautionary measures are taken — the writer gives a short description of the plant, so that farmers may be on the watch for its first appearance and check it before it becomes a serious nuisance.

The record of this *Plantago* by the Nantawarra Agricultural Bureau is the first notice of its occurrence in Australia.

It was probably introduced into South Australia in ballast, and may have spread up from the coast.

In some parts of Europe and in the Orient, a gummy substance is extracted from the seeds which is used for imparting a "finish" to textiles; it is also employed medicinally. Since however, on enquiry, it appeared very unlikely that any use could be made of the seeds in Australia, the writer recommends that this plant be destroyed wherever found. As it is an annual, this should be fairly easy, if the matter is taken in hand in time.

606 - ***Euphorbia Peplus* and *Aster subulatus*, Weeds of New South Wales.** — MAIDEN, J. H., in *The Agricultural Gazette of New South Wales*, Vol. XXVIII, Part 2, pp. 131-133, 2 Coloured Plates, Sydney, February 1917.

A description of *Euphorbia Peplus* Linn. (petty spurge) and of *Aster subulatus* Mich (bushy starwort). The first of these 2 plants is common in



the coastal districts of most of the Australian States ; like other *Euphorbias*, it has medicinal properties.

*Aster subulatus* occurs frequently in New South Wales, especially in damp situations.

## INJURIOUS INSECTS AND OTHER LOWER ANIMALS.

### GENERAL.

607 - List of the *Coccidae* of Porto Rico (1). — JONES, T. H., in *The Journal of the Board of Commissioners of Agriculture, Porto Rico*, Vol. 1, pp. 1-16. San Juan, P. R., 1917.

The list includes.

1) *Icerya montserratensis* Riley and Howard, collected : on orange at Mayagüez and at Bayamón ; on twigs and undersides of leaves of an undetermined tree at Santurce (near San Juan) ; on the undersides of leaves of "caimito", (*Chrysophyllum argenteum*) at Río Piedras ; on "maricao" (*Byrsonima spicata*), *Casearia sylvestris*, coconut palm, "guama" (*Inga laurina*), "guava" (*I. vera*), "saman" (*Pithecolobium Saman*), and "guayaba" (*Psidium guajava*) at Mayagüez.

2) *Orthezia insignis* Dougl., on an undetermined plant at Dorado ; on *Eupatorium odoratum* at Comerío ; on *Ipomoea tilacea*, at Río Piedras ; on *Coleus* sp., *Hamelia patens*, *Ipomoea fastigiata*, *Lactuca* sp. and *Lantana Camara*, at Mayagüez.

3). *Conchaspis angraeci* Ckll., on the branches of *Codiaeum* sp., at Mameyes ;

4) *Asterolecanium aureum* Bdv., on the leaves of an undetermined plant, at San Juan ;

5) *A. bambusae* Bdv. on bamboo at Bayamón, Utuado and Río Piedras ;

6) *A. lanceolatum* Green, on bamboo at Río Piedras ;

7) *A. pustulans* (Ckll.), on "guanábano" (*Anona muricata*) at San Juan and on a Leguminosae at Guayama ; on *Ficus Carica*, *Grevillea robusta*, *Castilleja* spp. and *Inga vera* at Mayagüez ; on "escoba" (*Sida antillensis*) and "jazmín" (*Jasminum Sambac*) at Río Piedras ;

8) *Phenacoccus gossypii* Towns. and Ckll. on cotton at Humacao ;

9) *Pseudococcus calceolariae* (Mask.), on sugar-cane at Río Piedras ; the fungus *Aspergillus flavus* occurs on this species.

10) *Ps. citri* (Risso) an enemy of citrus, pineapple and coffee in the island ; specimens of a coccid very closely related to this species were collected on the roots of celery (*Apium graveolens*), corn (*Zea mays*) and a grass (probably *Sporobolus jacquemontii*) at Río Piedras.

11) *Ps. nipae* (Mask.) on coconut palm (*Cocos nucifera*) at Santurce ; on guava or "guayaba" (*Psidium Guajava*), on *Anthurium acaule* sour-sop or "guanábano" (*Anono muricata*), *Chrysophyllum argenteum* and on *Musa paradisiaca* at Río Piedras ; on sea-grape or "uvero" ;

(1) See also B., June 1911, No. 2002 ; B., Jan. 1916, No. 129.

(Ed.)

(*Coccoloba uvifera*) and "aguacate" (*Persea gratissima*) at Naguabo; the fungi *Cephalosporium lecanii* and *Empusa Fresenii* live on this coccid.

12) *Ps. sacchari* (Ckll.), on sugar-cane at Bayamón, Mayagüez and Humacao; the larvae of *Karschomyia coccii* were found in colonies of *Ps. sacchari* (?) on sugar-cane.

13) *Chaetococcus bambusae* (Mask.), on bamboo at Mayagüez.

14) *Pulvinaria psidii* Mask., a species which is often very abundant on the "jobo" tree (*Spondias lutea*), and also reported on orange and coffee; it was found on mango (*Mangifera indica*), at Río Piedras, on (*Psidium guajava* at Río Piedras and Luquillo, on *Spondias lutea* at Arroyo and Río Piedras, on a tree, *Rauwolfia tetraphylla* at Ponce.

15) *Ceroplastes ceriferus* (Anderson), on "almacigo" (*Elaphrium Simaruba*) at Santa Rita, near Guánica, and on "yerba de San Martín" (*Sauvagesia erecta*) at Naguabo.

16) *C. cirripediformis* Comst., on an undetermined plant at Algarrobo.

17) *C. floridensis* Comst., on *Anona reticulata*, on citrus, rose and orange in the island; on *Rapanea guianensis* and *Ficus laevigata* at Río Piedras, and on *Psidium guajava* and *Mangifera indica* at Mayagüez.

18) *Vinsonia stellifera* (Westw.), often found in large numbers on the leaves of "pomarrosa" or rose apple (*Eugenia Jambos*), *Mangifera indica* and coconut, it was found on this last plant at Cataño (?), Arroyo and Santurce, on *E. jambos* at Río Piedras and Mameyes, on *Mangifera indica* at Santa Isabel, on "maguey" (*Agave sisalana*), *Musa* sp. and *Psidium Guajava* at Mayagüez;

19) *Inglisia vitrea* Ckll., on pigeon pea or "gandul" (*Cajanus indicus*) at Mameyes and Comerío; on "achiote" or "annato" (*Bixa orellana*) at Río Piedras.

20) *Coccus hesperidum* (Linn.) on *Agave sisalana* at Río Piedras.

21) *C. mangiferae* (Green) on *Eugenia Jambos* at Río Piedras; on *Mangifera indica* and *Cinnamomum zeylanicum* at Mayagüez; the fungus *Cephalosporium lecanii* is often found on this scale:

22) *Saissetia hemisphaerica* (Targ.), previously noted: on the egg-plant (at Cataño), on coffee, *Anona muricata*, cassava (*Manihot utilissima*), orange and *Citrus* in general in the island; recently noted: on "jasmin" (*Gardenia jasminoides*), the introduced pepper tree (*Schinus molle*), *Eugenia Jambos*, *Graptophyllum pictum*, *Persea gratissima* at Río Piedras; on "marunguey" (*Zamia integrifolia*), at Vega Alta; on *Sida*, sp., on black nightshade or "mata-gallinas" (*Solanum nigrum* var. *americanum*.), and *Psidium Guajava* at Luquillo; on "café" (*Coffea arabica*), and *Thunbergia erecta*, at Mameyes; on "orozuz" or "pascueta" (*Leptilon canadense*) at Ciales; on *Rauwolfia tetraphylla*, at Ponce; on *Antigonon leptopus*, *Drypetes glauca*, and *Solanum seaforthianum* at Mayagüez; the fungus *Cephalosporium lecanii* lives on this scale;

23) *S. nigra* (Wietn); on "almendra" (*Terminalia catappa*) and on cotton, at San Juan; on "anamú" or "cadillo pequeque" (*Pavonia Typhalaea*), at Canovanas; on "algodón" (*Gossypium barbadense*) at



Guánica; on China berry or "lilaila" (*Melia azedarach*) at Fortuna (near Ponce); on *Schinus molle* at Río Piedras; on *Solanum nigrum* var. *americanum*, *Melia azedarach* and *Sida*, sp. at Luquillo; on *Euphorbia sanguinea* at Mayagüez; from material including *S. nigra* and *Hemichionaspis minor* a parasite was reared which was identified later as *Arrhenophagus chionaspidis* Auriv;

24) *S. oleae* (Bern.) on Calabassa tree (*Crescentia Cuyete*) at Lares, on honey locust (*Gleditschia triacanthos*), at Adjuntas; on *Guazuma ulmifolia*, at Guayama; on *Terminalia Catappa*, Mayagüez and Guánica; on "madre de cacao" (*Erythrina glauca*) at Río Piedras, on orange oleander (*Nerium oleander*) and "berengena cimarrona" (*Solanum torvum*) at Mayagüez.

25) *Aclerda tokionsis* (Ckll.), on sugar cane at Río Piedras.

26) *Chionaspis citri* Comst., one of the most injurious scale-insects of the citrus; it appears to be generally distributed all over the island, its natural enemy is *Aspidiotiphagus citrinus* (Craw.)

27) *Howardia biclavis* (Comst.), on *Bixa orellana* at San Sebastián, Añasco and Río Piedras, on "caimito" (*Chrysophyllum cainito*) and "mamey" (*Mammea americana*) at Mameyes; on "algarrobo" (*Hymenaea Courbaril*), on *Casearia arborea*, on silver oak (*Grevillea robusta*), and *Cajanus indicus* at Río Piedras; on "palo de cucubano" (*Guettarda scabra*) and *Cordia* sp. at Dorado; on "roble" (*Tecoma pentaphylla*) and *Acalypha Wilkesiana* at Naguabo; on "níspero" (*Achras sapota*), *Coffea arabica*, *Doryalis cafra* and *Plumiera rubra* at Mayagüez.

28) *Diaspis echinocacti* (Bouché), recorded at Porto Rico by FERNALD.

29) *Aulacaspis peniagona* (Targ.), lives on many plant hosts in the island; already recorded on "higuerete" (*Ricinus communis*) at Río Piedras, on an undetermined tree at Bayamón, on peach at Adjuntas; on *Gleditschia triacanthos*; on "majagua" (*Paritium tiliaceum*) at Fajardo; frequent in the island on orange, mulberry, "papaya" (*Carica papaya*), plum; observed on *Hibiscus esculentus* and pepper; taken also from willow (*Salix* sp.) at Ponce; on "bruja" (*Bryophyllum pinnatum*?) at Comerío; on *C. papaya* and *Cajanus indicus* at Río Piedras; on *Paritium tiliaceum* at Mameyes and Adjuntas; on "cadillo" (*Urena lobata*) at Dorado; on *Ricinus communis* at Ciales; on *Mammea americana* at Naguabo; on *Hibiscus esculentus*, *Hyptis* sp., *Solanum torvum*, *Trema micrantha* and *Acalypha Wilkesiana* at Río Piedras; on *Mangifera indica*, *Erythrina* sp. and *Nerium oleander* at Mayagüez; on *Manihot utilissima* at Añasco.

30) *Hemichionaspis aspidistreae* (Sign.) on *Nephrolepis exaltata* var. *bostoniensis*, at Río Piedras;

31) *H. minor* (Mask), on eggplant at Cataño; on *Guazuma ulmifolia* at Guayama; on *Gossypium barbadense* at Guánica; on *Melia azedarach* at Fortuna; on "yerba rosario" (*Aeschynomene sensitiva*) and ornamental croton (*Codiaeum* sp.) at Naguabo; on "verbena" (*Valerianoides jamaicensis*) at Río Piedras; on *Solanum torvum* and "cadillo" (*Triumfetta semitribloba*) at Luquillo, on *Lantana involucrata* at Mameyes, on *Asparagus Sprengeri* and *Pithecolobium Saman* at Mayagüez.



32) *Pinnaspis buxi* (Bouché) on an epiphyte of the *Bromeliaceae* at Mameyes, on *Philodendron* sp. at Ciales, on "corozo" (*Acronomia media*) and *Areca lutescens* at Río Piedras ;

33) *Leucaspis indica* Mar., on *Mangifera indica* at Mayagüez ;

34) *Aspidiotus cyanophyllii* Sign. ; on *Eucalyptus* sp. at Naguabo.

35) *A. destructor* Sign. (seems to be the first scale-insect recorded on the island), is very common, especially on the undersides of the leaves of coconut palms, which it damaged seriously at Ponce in 1904 ; first collected at San Juan, it was also found later on the leaves of banana in the same district and at Cataño and Arroyo ; it has also been found on the coconut at Santurce, on silk oak (*Grevillea robusta*), *Psidium Guajava* and *Musa paradisiaca* at Río Piedras ; on *Persea gratissima* at Mameyes and Guayama ; on *Anona palustris* and *Mammea americana* at Río Piedras, and on date palm (*Phoenix dactylifera*) at Mayagüez.

36) *A. forbesi* Johnson, recorded at Porto Rico by FERNALD ;

37) *A. lataniae* Sign., on *Castilloa* at Mayagüez ;

38) *A. sacchari* Ckll., on sugar cane, at Guánica, Fortuna, Fajardo, Canóvanas, Río Piedras and Humacao ;

39) *Pseudaonidia tessarata* (de Charm.) on rose-tree at Mameyes ;

40) *Selenaspidus articulatus* (Morg.) on orange leaves at El Yunque ; on *Eugenia Jambos*, *Anona muricata* and *Ficus nitida* at Río Piedras ; on *Eucalyptus* sp. at Naguabo ;

41) *Chrysomphalus aonidium* (Linn.) a serious enemy of citrus in the island ; collected on *Terminalia catappa* and *Anona muricata* at San Juan ; on *Nerium Oleander* at Ponce ; on *Musa* at Caguas ; on *Ficus nitida* at Río Piedras ; on sisal hemp (*Agave sisalana*) at Mayagüez ;

42) *Chrys. aurantii* (Mask.) ; on *A. muricata* at San Juan and Ponce ; also recorded as injurious to citrus in the island.

43) *Chrys. biformis* (Ckll.), on "maya" (*Bromelia Pinguin*) at Mameyes ; on *Agave sisalana*, *Persea gratissima* and *Mangifera indica* at Río Piedras, on *Cycas revoluta* at Naguabo ;

44) *Chrys. dictyospermi* (Morg.), on *M. indica* at Río Piedras and on *C. revoluta* at Naguabo ;

45) *Chrys. personatus* (Comst.) on banana at Caguas and Cataño, on *A. muricata* at San Juan ; on coconut palm at Mayagüez, Caguas and Santurce ; on *Eugenia Jambos* at Río Piedras, on *M. indica* at Santa Isabel ; on *Ficus* sp. and *Mammea americana* at Mameyes ; on *Eucalyptus* sp. at Naguabo ;

46) *Pseudischnaspis bowreyi* (Ckll.), on *Asparagus plumosus* at Mayagüez ;

47) *Pseudoparlatoria ostreata* Ckll., on *Solanum seaforthianum* and *Acalypha* sp. at Mayagüez ;

48) *Lepidosaphes beckii* (Newm.), recorded more often than any other scale insect as injurious to citrus in the island ; also collected on *Codiaeum* at Río Piedras ; the fungi *Myriangium Duriaei* and *Sphaerostilbe coccophila* live on this species ;

49) *L. lasianthi* (Green), on leaves of *Croton humilis* at Río Piedras ;

50) *Ischnaspis longirostris* (Sign.) on coconut palm at Caguas, Cataño, Mayagüez and Arroyo; on *Citharexylum fruticosum* at Naguabo; on *Ixora ferrea*, *Asparagus Sprengeri*, and *Acronomia media* at Río Piedras. A bibliography of 25 works is appended.

608 - *Lepidosaphes tuberculata* n. sp., *L. diaspidiformis* n. sp., and *Dinaspis annae* n. sp., Scale Insects Recorded in Italy, Chili and Barbadoes Respectively. — MALENOTTI, ETTORE, in *Redia*, Vol. XII, Parts I-II, pp. 183-194, pl. I. Florence, 1917.

Description of the 3 following scale insects:

1) *Lepidosaphes tuberculata* n. sp.: males and females found in abundance on both sides of some leaves of *Cymbidium Tracyanum*, in the greenhouse of the Royal Pomological School at Florence (Italy) on May 3, 1916; many of the female scales were bored by parasites;

2) *L. diaspidiformis* n. sp.: males and females in plenty on the upper side of two leaves of *Myrceugenia planipes*, taken in the province of Llanquihue (Chili) by Prof. MARCIAL ESPINOSA BUSTOS of the National Museum of Santiago and sent to the Royal Station for Agricultural Entomology at Florence on May 29, 1916; some females were parasitised by a fungus that completely filled the body;

3) *Dinaspis annae* n. sp.: very abundant male and female scales on the branches of *Citrus Medica*, with *Lepidosaphes citricola* Pack. and *Aonidiella auranti* (Mask), taken at Barbadoes by Mr. H. A. BALLOU and sent to the Royal Station for Agricultural Entomology at Florence on July 4, 1916.

609 - On the So-called Varieties of the Scale Insect *Chrysomphalus dictyospermi*, Injurious to Citrus Plants. — MALENOTTI, ETTORE, in *Redia*, Vol. XII, Parts I-II, pp. 109-123, fig. 1-6. Florence, 1917.

According to the writer, there are no true varieties, properly so-called, among the recorded forms of the scale insect *Chrysomphalus dictyospermi* (Morg.) Leon, and called: *Chrys. dictyospermi* var. *pinnulifera* Mask., *Chrys. dictyospermi* var. *arecae* Newst., *Chrys. dictyospermi* var. *jamaicensis* Ckll., *Chrys. dictyospermi* var. *mangiferae* Ckll.

*Chrys. dictyospermi* attacks plants belonging to at least 80 species of about 25 widely different families, both in tropical and temperate regions. The scale is distributed in a zone vast from the point of view of latitude and very vast from the point of view of longitude. It attacks greenhouse plants (London, Florence, United States, etc.) as well as those grown in the open (Algeria, Sicily, Liguria, Spain, etc.).

The writer is of the opinion that the scale insect is more sensitive than many others to variations in environment. This sensitiveness, together with the wide distribution and large range of host plants of this insect, affords sufficient explanation of the many local forms which, on account of the facility with which their characters change, can not be considered as groups constituting varieties.



610 - *Bacillus Lymantriae*, *B. Liparis* n. sp. and *Diplococcus Lymantriae* n. sp., Parasites of the Larvae of the "Unlike Bombyx" (*Lymantria dispar*), in France. — PAILLOT, A., in *Comptes rendus hebdomadaires des Séances de l'Académie des Sciences*, Ist. Half-Year, 1917, Vol. 164, No. 13. pp. 525-527. Paris, 1917.

Three bacteria have been isolated from the larvae of the Macrolepidopteron *Lymantria dispar* L. The writer has provisionally identified one of them as that described by PICARD and BIANC under the name of *Bacillus Lymantriae*. The second is a *Diplococcus* forming a distinct species, and named by the author *D. Lymantriae*; it is not very pathogenic to the larvae and an inoculation of a pure culture is not always mortal. The third, provisionally named *B. Liparis*, is more pathogenic to the larvae of *L. dispar* than *Dipl. Lymantriae*.

611 - *Sorospora Uvella* and Its Occurrence in Cutworms in America. —

SPEARE, A. T., in *Journal of Agricultural Research*, Vol. VIII, No. 6, pp. 189-194. fig. 1. Pl. 66, Washington, D. C., February 5, 1917.

In 1888, SOROKIN described and illustrated as a parasite of the cutworm (*Agrotis segetum* Schiff.), in Russia, a fungus which he called *Sorospora agrotidis* n. gen. and n. sp. As regards the systematic position of the parasite, which was not defined by SOROKIN, subsequent writers have suggested its affinity to the Entomophthorales on account of its apparent resemblance to the genus *Massospora* Peck, which FORBES and THAXTER have shown to be entomophthoraceous.

In 1889, GIARD translated SOROKIN's article into French, and in the issue of the publication, followed it by a note in which he pointed out that *Sorospora agrotidis* was undoubtedly identical with *Tarichium uvella* Krassiltschik (1886).

Since, as is shown by the writer, the fungus in question is in no way connected with the Entomophthorales, the use of the generic name of *Tarichium* becomes invalid. Hence the correct name for the organism is *Sorospora uvella* (Krass.) Gd. since Giard was the first to recognise that the form described by SOROKIN was identical with that described by Krassiltschik.

The writer received in June 1916, two larvae and one pupa of *Euxoa tessellata* Harris which had died in breeding jars. The insects originally came from College Park, Md. No fungus was visible externally, but upon breaking open the larva a reddish-brown powdery spore mass was seen which completely filled the interior of the insect's body. Microscopic investigation demonstrated that the fungus was *S. uvella*. Several more infected insects were received in July.

So far as the writer is aware, there is no record of *S. uvella* in Europe since 1888, and further, this seems to be the first published account of its occurrence in America, except for a brief note of its presence in Ottawa, Canada in 1915 by GIBSON. The writer hopes soon to test the parasitism of *S. uvella* and to give an account of these experiments, as well as to make a more complete study of the life history of the organism.



- 612 - *Scutellista gigantea* n. sp., a Chalcid Parasite of the Coccid *Ceroplastes mimosae*, in Eritrea. — BERLESE, ANTONIO in *Redia*, Vol. 12, Pt. I-II, pp. 179-180. Florence, 1917.

A systematic description of the new hymenopteron *Scutellista gigantea* taken from *Ceroplastes mimosae* Sign. (= *C. africanus* Green), and found in Eritrea by Dr. GUICCIARDINI.

INSECTS  
INJURIOUS  
TO VARIOUS  
CROPS

- 613 - *Chaetocnema ectypa* ("the desert corn flea-beetle") a Coleopteron Parasitic on Cultivated Gramineae and Lucerne, in the United States of America. — WILDERMUTH, V. L., in *United States Department of Agriculture, Bulletin* 436, pp. 1-23, Fig. 1-7, 1 Pl. Washington, D. C., February, 1917.

*Chaetocnema ectypa* Horn, is present in injurious numbers in the cultivated areas of the southwestern United States, where it attacks maize, sorghum, sugar cane, wheat, barley and lucerne. From the fact that it is a native of southwestern desert regions, the little black insect has been named the "desert corn flea-beetle". Both the adults and larvae injure crops, the former feeding upon the top of the plants, and the latter upon the roots.

The eggs are deposited at, or near, the surface of the ground, and hatch in about 6 days. The young larvae are found within the tender roots of the food plants, while the older larvae live in the soil near these roots. The average length of the larval stage is 32 days.

The prepupal and pupal stages are both passed within a cell in the soil near the roots on which the larvae feed.

The flea-beetles in the adult stage hibernate under rubbish, or at the base of various grasses growing in the regions of infestation (*Hordeum murinum*, *Distichlis spicata*, *Sorghum halepense*, *Sporobolus airoides*, etc.).

The total length of the life cycle of this beetle is about 7 weeks, there being from 3 to 4 generations in the year.

The number of adults can be greatly reduced by the destruction of their hibernation quarters and the eradication of some of their weed food plants (*S. halepense*, *D. spicata* etc.). They can be further diminished by carefully cultivating those crops which can be grown after irrigation as soon as the soil becomes dry. This method destroys a great many pupae. Small plots of maize can be sprayed successfully with arsenate of lead, using 2 pounds to 50 gallons of water, the water being made into a strong soap solution. This acts both as a repellent and as a poison to the beetles.

Injury to maize and other crops can be partially overcome if the soil is placed in the best possible cultural condition by the addition of farmyard manure, or other fertilisers.

At Tempe (Arizona) the adult flea-beetles have been observed to be preyed upon by the nymphs and adults of *Reduviolus fesus* L., while in the same district the writer discovered that a small parasitic wasp, *Neurepyris* sp. attacked the larvae and prepupae of *Chaetocnema ectypa*. At Holtville (California), the writer found a great many of these beetles with their bodies almost covered with a species of mite (*Pediculoides* sp.).

614 - Investigations on *Helopeltis*, a Capsid Parasite of Tea. — LEEFMANS, S., in *Mededeelingen van het Proefstation voor Thee*, No. 50. Batavia 1916.

The following species of *Helopeltis* occur in Java: *H. antonii* Sign., *H. theivora* Waterh., *H. cuneatus* Dist., and *H. cinchonae* Mann.

*H. antonii* is the chief enemy of tea in Java. At over 4300 feet in altitude occurs a local variety of *H. antonii* which was formerly described as *H. bradyi*. It is now provisionally named *H. antonii* var. *bradyi*. The variety differs from the type in some morphological characters, as well as in the fact that it usually attacks *Cinchona*. Tea is rarely attacked and then never severely.

*H. theivora*, which is the most dangerous enemy of tea in British India does not do much harm in Java: in West Java it only occurs in the lowlands.

*H. cuneatus*, a new species for Java that does not attack tea and is only found on plants of the family Araceae.

*H. cinchonae*, also new for Java, has recently been found to attack tea and may become serious in the future.

The writer gives a detailed account of the biology of these species and finds that *H. theivora* is in many ways similar to *H. antonii*. The important difference in the duration of the various stages of *H. antonii* at different altitudes is fully discussed. At 800 ft. the life cycle requires 19 to 22 days, and at 3600 ft. 23 to 35 days. The females lived as long as 50 days, while the highest number of eggs laid in 34 days was 235.

The cause of the damage to the tea leaf is not certain, but the spots are supposed to be caused by an excretion. As the results of several experiments to determine the average damage caused by larvae and adults it was calculated that the progeny of one female, can spoil about 2.8 milliard kilos of leaves in 6 months.

The natural enemies of *Helopeltis* are discussed. Some species of Mantids eat the larvae and adults, but they are of little practical importance. The Reduviid *Sycanus collaris* F. is also not important as a control. Spiders were imported from Europe, but though they were successfully imported, their value is not yet clear. An ant *Dolichoderus bituberculatus* Mayr. attacks *Helopeltis* on *Theobroma Cacao*, the cacao-tree, but its use on tea plantations is not possible for practical reasons. Experiments with other Rhyncota that parasitise the eggs of *Helopeltis* were unsuccessful.

*Bacterium* found in a dead *Helopeltis* was grown in culture, but gave no convincing practical results. An insectivorous fungus *Metarrhizium* gave better results, but its practical application is, as yet, uncertain.

Belts of trees planted to keep the insects from the plantations are useless and may become dangerous, as they act as traps for insects carried by the wind and thus are collected at the plantations. In one case, cutting down a belt of trees gave a good result, allowing free entry to the wind.

As regards the influence of climatic conditions, an enquiry made on 57 estates showed that drought is usually fatal to the insects.

The original food plants of *H. antonii* in the jungle and forest could not be found, though there is evidence to show that *Helopeltis* passes the



dry season in the jungle, few insects being then found on the tea. The dry season is, therefore, a suitable time for a strict control over the few surviving insects.

In experiments as to immune varieties while it was found that all the Javanese varieties were attacked, the Java-China tea suffers the most of all.

The planters in Java formerly thought *Cinchona* and *Tea* were each attacked by a separate species. On the contrary, the writer found that up to 4300 ft. *H. antonii* Sign. (type) attacked both plants, while over 4300 ft in altitude the var. *bradyi* is found, which usually prefers *Cinchona*. The presence of *Cinchona* under 4300 feet may be considered as dangerous if near tea.

An elaborate investigation has been made of the food plants of *H. antonii* and *H. theivora*, especially of the weeds occurring in the tea gardens, and of the leguminous plants used for green manuring. The following species of leguminous plants are badly attacked by *Helopeltis* under laboratory conditions: *Albizzia moluccana* Miq., *Erythrina indica* Lam., *Tephrosia Vogelii* Hook. f., *Teph. Hookeriana* Wight et Arn. The insects can live on these plants for several weeks. Weeds, which were attacked under laboratory conditions, and on which *Helopeltis* lived for a considerable time, are: *Richardsonia brasiliensis* Hayne, *Melastoma malabathricum* L., *Erigeron linifolius* Willd., *Bidens pilosa* L., *Dichrocephala latifolia* DC., *Erechtites valerianaefolia* DC. Also in the tea gardens damage by *Helopeltis* was observed on these plants principally when the tea was pruned low.

The Awi tali Bamboo (*Bambusa Apus* Schult. f.) may be considered as suspect, as the insects remained alive on this plant for 10 days. On Casso (*Saccharum spontaneum* Linn.) and Alang alang (*Imperata arundinacea* Cyr.) the insects died within two or three days; these grasses are thus probably not food plants. Some plants were found spotted on the secondary wood, as if attacked by *Helopeltis*; the damage was not due to *Helopeltis* but to another Capsid bug: *Pachypeltis vittiscutus* Bergr. The affected plants are: *Villebrunea rubescens* Blume *Leca aequata* Linn., *Arthrophyllum diversifolium* Blume and *Saurauja* sp.

Both *H. antonii* and *H. theivora* feed on a large variety of plants.

The connection between the pest and the cultural methods for tea in Java is discussed. No definite opinion could be formed as to whether forced plucking had any favourable effect, as the results varied greatly.

The idea of some planters, that the tea would become immune after several attacks, has no sound foundation. The cause of the spontaneous disappearance of the pest in some cases, can, as far as the author can see, only be due to lack of food, removal of the pest by the wind or special climatic conditions.

Pruning is often tried to get rid of the pest, but it is often forgotten that this measure causes a migration of the insects which may become very fatal when newly pruned gardens are adjacent, or where the tea is in a weak condition consequent upon pruning. In this case pruning must be delayed until the danger has decreased. If low pruning must be done, it



must be taken into account that pruning of small plots is to be avoided. Pruning of large areas (say 40 bahoes in one month) will delay re-infection for a longer time. As the insects are carried in the direction of the prevailing winds, it is advisable to prune the gardens with the wind and never against it.

Weedy gardens are as a rule not more attacked than clean gardens. Methods such as: 1) fumigating with the smoke from burning rubbish with or without sulphur, 2) fumigating the shrubs individually with sulphur cartidges, 3) scorching the shrubs by means of soldering lamps, are of no avail.

The following measures are discussed as regards their utility for combating the pest: :

1) Twigs containing eggs should be collected before they hatch out.  
2) Catching *Helopeltis* by hand is often very effective, if started as soon as the pest appears. Most of the tea planters in Java carry out hand-catching. The early morning is a good time for catching the larvae but the work, should be continued through the whole day, if possible.

3) Experiments were made with different insecticides, but the spray, even if strong enough to kill the plant, does not kill all the eggs. Larvae and adults can be destroyed by spraying with a 2 % soap solution. Spraying was found to be cheaper than handcatching. Spraying should be carried out immediately after pruning, and may be continued for 7 months, after which handcatching must be applied, as the shrubs are then very dense. Spraying and handcatching combined gave good results. In fixing the periods between two successive gangs of spraying or hand-catching, the length of the larval stage must be considered.

4) Pruning of small areas is not advisable. The best is to prune a large area rapidly, says about 40 bahoes per month. Pruning should take place with the wind, never against it; in the rainy seasons the prunings must be destroyed the same day, while in the dry season it suffices to spread them out in thin layers. Adjacent estates should make an agreement as to the time of pruning so as to prevent one estate being infected by another. Thus a badly attacked garden should not be pruned if a newly pruned garden is adajacent.

5) Weeding must be done at the same time as or immediately after pruning.

6) If tea is grown near *Cinchona* at an altitude of less than 4300 feet, pruning of *Cinchona* and other cultural methods which cause migration of the pest from the *Cinchona* to the tea, must be done before the adjacent tea gardens are pruned.

7) Leguminous plants, which are also host plants of the insect must be avoided; if they have been planted they must be pruned at the same time as the tea.

Hedge plants such as *Bixa Orellana* Linn. and *Gardenia grandiflora* Lour. must not be allowed to grow near tea gardens. If *Helopeltis* accumulates at the edge of the forest, or in tree belts, the complex of plants harbouring it should be destroyed.

8) Remedial measures must be applied at the first appearance of the pest which must never be allowed to become serious. Premiums should be given to ensure careful control and searching. Handcatching or spraying when the pest has become serious are useless, and simply a waste of money.

615 - *Pseudococcus nipae* (= *Dactylopius nipae*), a Scale Insect Injurious to Palms, in Hungary. — JABLONOWSKI, J., in *Zeitschrift für Pflanzenkrankheiten*, Year 1917, Vol. 27, Part 1, pp. 1-18. Stuttgart, February 15, 1917.

During some experiments made in a glasshouse in Hungary in February, 1916, the author found on a palm a number of male scale insects, which he at first thought to be *Pseudococcus adonidum* L., a very common insect of Hungarian glasshouses. Further examination of the insect and particularly of the females showed that it was a species new to Hungary, *i. e.* *Pseudococcus nipae* (Mask.) Fern. (= *Dactylopius nipae* Mask.), first described by MASKELL in an Australian publication. Later, NEWSTEAD (1893), MARCHAL (1908) and LINDINGER (1912) have described the insect.

In studying the literature, the Author found that the descriptions by the three scientists did not agree and that they were inexact on several points. As he had abundant material, the writer has carefully studied the insect. In the present work, he gives a detailed account of the morphological, physiological and biological characters of the insect and compares his results with that of the previous authors, finally dealing with the geographical distribution and economic importance of this scale insect.

*Ps. nipae* has probably been imported into Hungary from Belgium with palm trees. The insect is very common in glasshouses at Budapest. It is found on very different palm trees, chiefly on *Phoenix*, *Kentia*, *Lalania* and *Areca*, to which it causes considerable damage; but the writer thinks that the damage would be less than that of *Ps. adonidum*, if the palms were cleared from time to time.

This does not prevent the scale insect from becoming a serious pest, and the author advises German and Austrian gardeners and experimentalists to determine the glasshouses invaded by the pest so as to check its spread.

616 - *Tarsonemus* sp., a Mite Parasitic on Cyclamens in Ontario, Canada. — Ross, W. A., in *The Agricultural Gazette of Canada*, Vol. 4, No. 3, pp. 174-175, 1 fig. Ottawa, March 1917.

During 1916, several complaints were received from florists in Hamilton, Brantford and Niagara Falls concerning a cyclamen disease which, by destroying the flowers and flower buds and curling the foliage, made the affected plants absolutely worthless. One florist on account of this trouble had been obliged to throw out nearly 900 out of 1 000 cyclamens.

On examining some of the diseased plants, it was found that the injury was produced by a minute mite reported by Mr. G. H. MOZNETTE, of the Oregon Agricultural College, to be an undescribed species of *Tarsonemus*. He further stated, that the same mite attacks various green-

house plants on the Pacific coast, where it has proved a very serious pest, and many florists have lost their whole crops through it.

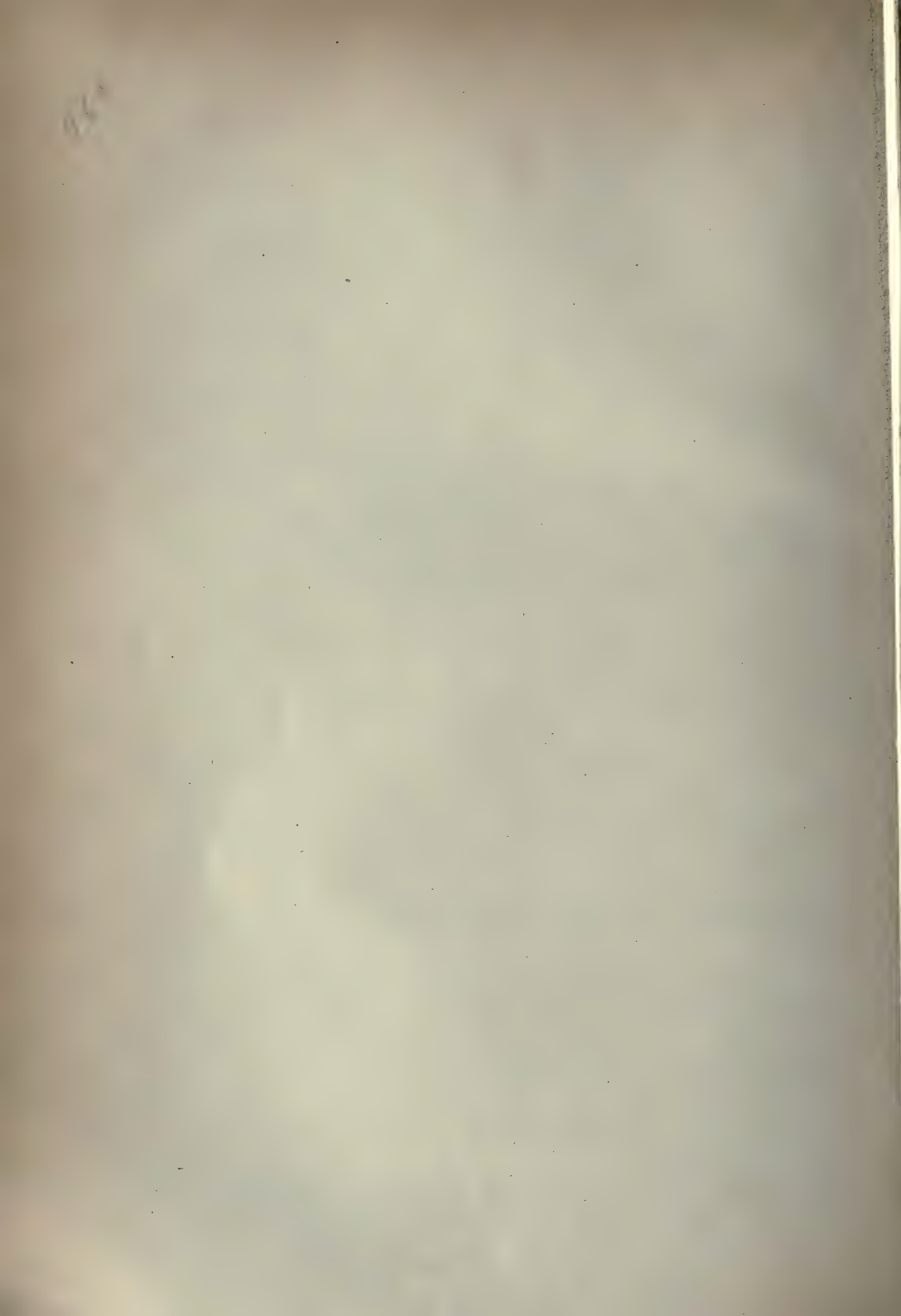
The mites, in all stages, including the eggs, occur on the bloom and tender foliage. They may be found on almost any portion of the flower, (petals, stamens and ovary), but as a rule, most of them are discovered between the calyx and corolla. Attacked flowers become distorted, streaked and flaccid and die prematurely. In many cases, the flower buds do not open, but gradually wilt and die. Infested foliage becomes curled; at the point of attack, little depressions, or pockets, may be formed and the leaf epidermis may assume a dark, purplish and cracked appearance.

The adult mites are pale brown, ovate creatures about 0.2 mm. long. The immature forms are translucent. The eggs are oval and translucent bodies about 0.12 mm.  $\times$  0.06 mm.

According to Mr. MOZNETTE, the parasite has been satisfactorily controlled in Oregon by spraying with a nicotine solution. The spray should be applied first when the young cyclamens are potted. From then until the flower buds are formed, subsequent applications should be made at intervals of 10 days.

It is highly probable that the addition of soap to the nicotine solution (3.6 to 4.8 ‰) would make it more effective.





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FIRST PART.  
ORIGINAL ARTICLES

**Wheat Production in Canada.**

BY L. H. NEWMAN

*Secretary of the Canadian Seed Growers' Association, Ottawa, Canada.*

The production of wheat in Canada extends from the Pacific in the West to the far Atlantic in the East, a distance of 3 653 miles. Wheat is also grown from the southern boundary to as far north as Dawson City, in 64° N. Lat. It is not grown in commercial quantities, however, much north of 54° N. Lat. except in a few small localities.

Roughly speaking, the Dominion may be divided into six main sections in regard to its wheat production.

1. MARITIME PROVINCES: In the Maritime Provinces, which comprise the provinces of Prince Edward Island, Nova Scotia and New Brunswick wheat growing is carried on to a comparatively limited extent, there being approximately 62 000 acres in the three Provinces devoted to this crop. Practically all wheat produced belongs to the spring-sown varieties and is consumed at home. The varieties most commonly grown are White Russian, White Fife, Red Fife and Marquis. The quality of the wheat produced is not usually so good as is that of the wheat grown further west, a considerable proportion of kernels being starchy. This is particularly true of the White Russian wheat.

2. QUEBEC: Approximately 70 000 acres of lands are devoted to the raising of wheat in Quebec, the varieties most commonly grown being Red Fife, White Fife, Huron and Marquis. The wheat produced in this Province is often not quite so attractive as is that produced on the Western prairies, but when hard wheats such as Fife or Marquis are used, the quality is quite up to that of the Western grown grain.

3. ONTARIO: In Ontario, both spring sown and autumn sown varieties are used, the former being confined chiefly to the Eastern and Northern parts of the Province, while the latter are used almost exclusively in the

Western and Southern parts. In round numbers about 900 000 acres are devoted to the production of autumn wheat while only 120 000 produce spring sown sorts.

*Autumn wheat in Ontario. \**

The autumn varieties are usually sown in September. At the Ontario Agricultural College, Guelph, almost 300 varieties of autumn wheat and a large number of selections and crosses have been under experiment during the past twenty-five years. In 1915, seventy-six different lots of wheat were tested under uniform conditions. These included 39 named varieties, 23 hybrids and a number of selections. Of the named varieties, fourteen have been grown in each of the past nineteen years. The results obtained are as follows:

Variety	Colour of grain	Pounds per measured bus. (18 yrs).	Yield per acre	
			Average 19 years	
			Tons straw	Bushels grain
Dawson's Golden Chaff. . . . .	White	60.0	2.9	51.1
Imperial Amber . . . . .	Red	61.2	3.2	48.1
Early Genesee Giant. . . . .	White	60.1	3.0	46.5
Egyptian Amber. . . . .	Red	61.8	3.2	46.4
Early Red Clawson . . . . .	Red	59.0	2.8	46.1
Rudy. . . . .	Red	61.6	2.7	45.0
Tasmania Red. . . . .	Red	61.9	2.9	44.4
Geneva. . . . .	Red	62.4	3.0	43.9
Tuscan Island. . . . .	Red	61.2	2.9	43.3
Kentucky Giant. . . . .	Red	61.3	2.8	43.2
Turkey Red. . . . .	Red	61.4	2.7	43.0
Treadwell. . . . .	White	60.1	2.8	41.7
Bulgarian. . . . .	White	60.7	2.8	41.5
McPherson. . . . .	Red	61.7	2.6	41.5

The variety most commonly grown throughout the Province is Dawson's Golden Chaff, which variety has held first place for a considerable number of years. This sort produces a very stiff straw of medium length. The heads are beardless with reddish chaff and white grain which usually weighs slightly over the standard per measured bushel. The quality of the grain has not been held in particularly high esteem by millers, although

\* From Bulletin 228, "Farm Crops", Ontario Agricultural College, 1915, by Dr. C. A. Zavitz.

it is believed to be improving somewhat as years pass by. While certain other sorts are preferred by the miller, yet on account of the superior yield and stiffness of straw the producers still favour this sort.

Imperial Amber produces wheat of rather better quality but is not quite so productive nor so strong in the straw. The head is also bearded and therefore less popular.

A number of varieties other than those mentioned in the table have been tested during the past five years. Of these the most promising are Grand Prize, Kharkov, Yaroslaf and Crimean Red. These, in productiveness, rank in the order given, but none were quite equal to Dawson's. The varieties which have produced the heaviest weight of grain per measured bushel in the five years' test are Rudy, 62.4; Egyptian Amber 62; Geneva, 62.4.

In the average results of five years' test, the Yaroslaf was the freest and the variety known as the Abundance was the most severely affected by rust. Dawson's Golden Chaff was the earliest to mature, while the Yaroslaf and Banatka were the latest.

In each of the past seven years 24 varieties of autumn wheat have been carefully tested at the College for bread production. Those varieties which produce the largest loaves from equal quantities of flour on the average are as follows:

Banatka, Crimean Red, Yaroslaf, Tuscan Island, Tasmania Red, Egyptian Amber, Budapesth, Rudy, Treadwell, McPherson and Bulgarian.

#### *New varieties of autumn wheat.*

A considerable amount of work has been carried on at the College in recent years in attempting to produce improved sorts. Crosses have been made between Dawson's Golden Chaff and some of the varieties possessing particularly high qualities such as Crimean Red, Tasmania Red, Turkey Red and Imperial Amber. The most promising crosses at present are those obtained from the Dawson's Golden Chaff and the Tasmania Red, some of these excelling in yield any of the named varieties.

#### *Spring Wheat in Ontario.*

As already intimated, the production of spring wheat in Ontario does not occupy a specially important place. The varieties most commonly grown are Red Fife, and Marquis. White Russian, which occupies a prominent place in the Maritime Provinces, is not grown to any extent in Ontario.

A variety not mentioned above but which is grown to a considerable extent is known as Wild Goose. This sort belongs to the Durum species and is not used commonly for bread-making but rather for the manufacture of macaroni and for poultry-feeding.

4. MANITOBA AND SASKATCHEWAN: During the past twenty years the production of wheat in this section of Canada has increased enormously.



While wheat growing in this country dates back to the beginning of the seventeenth century, yet it was not until after the means of transportation in the newer parts of Western Canada had become greatly developed that any very substantial increase in production took place. In this region millions of acres of fertile prairie soil, rich in organic matter awaited the advent of the husbandman who hitherto had been practically debarred by the enormous distances. With the extension of the various lines of railway, however, these vast tracts became opened up and now we find towns and villages and enormous stretches of cultivated fields where formerly the buffalo roamed unmolested. In 1901 the area devoted to wheat production in the above two Provinces, namely Manitoba and Saskatchewan, was slightly over two million acres and this represented about one-half the total wheat producing area in the entire Dominion. In 1916 there were 11 000 000 acres devoted to the production of this grain in Manitoba and Saskatchewan. In all Canada there were about 13 000 000 acres under wheat. This area produced 220 367 000 bushels. The five year average, 1909-1913, is 204 711 000 bushels. In the bumper year, 1915, 426 746 600 bushels were realized. Practically all the wheat grown in Manitoba and Saskatchewan is sown in the spring, there being very little autumn wheat used. The varieties most commonly grown at present are Marquis and Red Fife.

5. ALBERTA: In Alberta there were 2 571 670 acres devoted to wheat production in 1916. Of this all but 42 238 acres were devoted to spring wheat, the remainder being occupied by autumn wheat. Autumn wheat growing is confined chiefly to the southern parts of the Province, not being grown to any extent north of Calgary. The most common varieties of autumn wheat grown in Alberta are Kharkov and Turkey Red. The spring wheats, Marquis and Red Fife are the varieties grown almost exclusively.

6. BRITISH COLUMBIA: In this Province wheat is grown only on a small scale, and is used almost entirely for home consumption. Both autumn and spring sown varieties are used. The yields realized are fairly good, as is also the quality.

### *Wheat Breeding Work.*

Apart from the work which has been done at the Ontario Agricultural College, and which we have already described, practically all breeding work with wheat has been done at the Experimental Farm, Ottawa. When the Dominion Experimental Farms were first established, one of their first concerns was the production of varieties of wheat better suited to cope with the severe conditions of the great wheat growing areas of the West. The short summer of the prairies demand that the sorts grown be capable of maturing in time to avoid serious damage by early fall frosts. At the same time the high cost of transport to the great wheat consuming centres rendered it imperative to produce a particularly high priced wheat, namely a hard wheat. The settlers at the time found that Red Fife wheat was fairly satisfactory on the whole excepting in regard to the time which it required to reach maturity. Failure to mature before frost often resulted

in enormous losses, thereby rendering wheat-growing a more or less precarious occupation. The director of the Experimental Farms the late Dr Wm. Saunders, consequently undertook the task of producing an earlier maturing sort which might still possess the high milling qualities of Red Fife. Importations of many sorts from different countries were made and soon experiments in cross-breeding were begun. Red Fife was used as one of the parents in almost all of the crosses made.

None of the importations from other countries proved satisfactory in themselves although some were of great value in cross-breeding work. One of the most valuable is that known as Ladoga, a variety brought from Russia. This sort was rather inferior in quality but was from two to three weeks earlier in ripening than was Red Fife. Crosses made between these two sorts however proved exceedingly interesting and valuable, combining as they did to a considerable extent the high quality of the one with the early maturity of the other. Four of the most promising crosses were Preston, Stanley, Huron and Percy. These sorts soon became fairly widely distributed, especially in those districts which were most liable to suffer from early frost.

They were on the average from seven to ten days earlier than Red Fife, but were not usually regarded so favourably as was the latter, by the millers.

In 1903 Dr. CHAS. SAUNDERS became cerealist and immediately undertook to select the varieties obtained from the different crosses which had been effected up to that time. Hitherto the system of selection after crossing had not been so thorough as was now known to be necessary. This work produced good results effecting as it did a very decided improvement in the varieties mentioned. Many other promising crosses have also been made and of these the cross to which the name "Marquis" has been given stands out pre-eminent. The history of this cross is interesting. A few years before Dr. Charles Saunders took up the work a cross had been made between Red Fife and a wheat brought from India known as "Hard Red Calcutta". The product of this crop did not receive any special consideration until Dr. Saunders took up his work in re-selecting old crosses. It was not long however until the remarkable qualities of this cross became apparent and as time passed the value of the sort became more and more assured, in fact there is no wheat grown in Canada to-day which possesses so many desirable combinations of characters. It matures from four to twelve days before Red Fife and very often produces from ten to fifty per cent. greater yields. It has excellent milling qualities, producing a flour of good colour and high baking strength. On summer fallows where Red Fife is liable to lodge, Marquis usually stands erect. Owing to its early maturity it is not so badly affected by rust as are sorts which take longer to mature. For six successive years the highest award in International Competitions in America for the best hard wheat has been won by Marquis.

In addition to the other varieties mentioned above, there are now on hand at the Experimental Farm a very large number of promising sorts which have been produced from crosses made in more recent years. These



are being investigated with a view to finding, if possible, a sort which may mark a still further advance. The investigations conducted with wheat at the Experimental Farm have been greatly aided by the use of a small experimental flour mill and the development of scientific methods of determining baking strength.

The introduction of these earlier maturing sorts has resulted in extending the area of profitable wheat production, since these sorts can be grown fairly safely in districts where hitherto wheat growing was not considered advisable. Furthermore the use of early maturing sorts in districts where Red Fife already has given good results has permitted a better distribution of labour by lengthening the harvesting season.

#### *Wheat Improvement by Selection.*

While cross-breeding has been resorted to as a means of producing new combinations of characters which may mark the beginning of new and superior races, yet considerable improvement has been effected even in certain old varieties by selection; for example in Red Fife, a type which matures somewhat earlier than the mother sort, was isolated. To this selection the name of "Early Red Fife" was given. This sort, while resembling Red Fife in all essential particulars ripens earlier and possesses certain other minor points of difference. Unfortunately this sort has shown a rather high susceptibility to the attacks of rust and for that reason, in part at least, it has not been largely grown.

#### *Selection by Members of the Canadian Seed Growers' Association.*

It has been a common observation for many years that the wheat fields of Canada very often contain a variety of types, each differing from the other in points of considerable importance. Thus some types would mature much earlier than others; other types would possess a stronger straw than their neighbours; others again seemed more susceptible to rust and other diseases. Recognizing the difference in practical value between such types, a movement was started in 1900 which aimed to encourage a greater interest in the importance of using pure seed. The movement took the form of a competition which three years later resulted in the organization of the Canadian Seed Growers' Association. The members of this Association consist of farmers who are anxious to provide themselves with the best possible seed and who, to this end, agree to follow a certain system of selection under expert direction. At first it was not only thought to be possible to purify the variety by a process of continuous selection which would gradually eliminate the less valuable strains, but it was also believed to be quite within the range of human possibility to effect certain definite improvements in the strain.

By taking advantage of variations which seem to be in an advantageous direction, it was hoped that strains of superior value might gradually be built up. This idea has been considerably modified during recent years.



At the same time experience shows that ordinary "mass selection" is a potent means of at least maintaining a high degree of purity in improved stocks.

When the Association first took up its work there was practically no pure seed in the country. This made it necessary for each member to start with ordinary unimproved seed. The system adopted required that a selection of heads be made each year from the the mature crop in sufficient quantity to get enough clean seed to sow at least one quarter of an acre the following year.

From that quarter acre plot a similar selection had to be made for another plot the following year, and so on. Growers who have followed this system faithfully have produced strains which possess a high degree of purity and which are also exceedingly productive and decidedly outstanding in other respects. Thus in Red Fife wheat we have a strain produced by Dow Brothers, of Gilbert Plains, Manitoba which is outstanding in all practical qualities. These people have selected continuously for sixteen years according to the above system. Banner oats, produced by the same growers after many years of careful selection also occupies first rank among the hundreds of oats varieties grown in Canada. Another strain of Banner oats which is particularly noteworthy on account of its high industrial qualities is that produced by Thomas Waugh of North Bedeque, P. E. I. Between these two points, separated as they are by enormous distances, are to be found many members of the Association who have done creditable work by simple mass selection. As time passes the value of this sort of systematic work by farmers themselves on their own farms is repeatedly emphasized. In Western Canada the growers of Marquis wheat are confronted with the problem of maintaining purity and uniformity in this now famous wheat.

This problem is one which is worthy of the best efforts of all concerned, but it is only by some sort of organized effort such as that fostered and encouraged by the Canadian Seed Growers' Association, that it may be accomplished.

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## SECOND PART. ABSTRACTS

### AGRICULTURAL INTELLIGENCE

#### GENERAL INFORMATION.

#### RURAL HYGIENE

#### 617 - Observations on Certain Flies Infecting Meat or Causing Human Myiasis.

DEKLER, GUSTAV, in *Zeitschrift für Fleisch- und Milchhygiene*, Year 27, Part 3, pp. 35-38; Part 4, pp. 52-54; Part 5, pp. 68-71, Berlin, Nov. 1 and 15. and Dec. 1, 1916.

The writer has visited two of the biggest meat markets in Vienna and has carried out observations on the live adults, eggs, larvae, pupae, etc. of flies which visit meat. The flies were captured by means of a special apparatus at the moment of alighting on the meat. In order to obtain the larvae, various pieces of meat were exposed on the roof of the market. After the flies had deposited their eggs, the pieces were removed to the laboratory in order to allow the eggs to hatch. Altogether, some 10 000 flies were caught and 98 larvae obtained in the laboratory.

The following are the conclusions derived from these observations:

1) Flies prefer, both for egg-laying and feeding, fresh meat at a temperature of at least 17°C. Chilled or frozen meat is avoided by them.

2) The eggs are laid for preference in those portions of the meat which are fairly damp, warm and not directly exposed to sunlight: abdominal cavity, lower part of back, muscle folds, etc.

3) The species most frequently occurring on meat are: *Lucilia sericata* Meig. — *Calliphora erythrocephala* Meig. — *Sarcophaga haemorrhoidalis* Meig. — *S. nurus* Rond. — *S. falcitata* Pandellé. — *Phormia groenlandica* Zett. — *Muscina stabulans* Fall. — *Fannia canicularis* and *F. scalaris* L. The following rarely occur on meat: *Ophyra leucostoma* Wiedem. and *Drosophila funebris* Fabr.; they feed on it but never oviposit. The same thing holds for *Musca domestica* — *Calliphora vomitoria* — *Sarcophaga carnaria* — *Musca meridiana* and *Stomoxys calcitrans*.

4) The presence of the larvae of these flies affords no evidence as to whether the meat is putrid or not.

5) The dimensions of the larvae can only be determined with precision after they have been killed; the size is practically of no use for determining the length of infection.

6) If the infected meat is exposed to a temperature of 10°C. the process of hatching is arrested and the eggs gradually die off.

7) The larvae die if exposed to direct sunlight or if the medium in which they occur becomes dry.

8) A temperature of below 7°C. arrests the development of the larvae but does not kill them. The optimum growth temperature is between 20° and 40° C. The larva pupates on the 5th. or 6th. day after hatching, both at the above temperatures or at a temperature of 15° to 17° C.

9) Meat containing larvae can be dangerous to man if eaten raw.

10) No effective method is yet known for protecting meat from becoming infested with flies. At present, the best way is to keep the meat in a cool, dark place. The larvae are not killed either by washing the meat with vinegar or a solution of potassium permanganate, or even by immersing the meat in these two liquids.

618 - **The Station for Forestry Research in Denmark.** — *Det Forstlige Forsøgsvæsen i Danmark*, Vol. IV, Part 4, pp. 461-463. Copenhagen, 1915 (1).

In 1883, there was established in Denmark a Section for research in forestry, as a branch of the Office for the Management of State Forests. This arrangement continued down to 1901 when the Minister of Agriculture organised the Station for Forestry Research.

The management is in the hands of a chief of Station, in conjunction with a commission of 2 representatives of the Forest Administration — 2 representatives of private sylviculture — 1 representative of forestry instruction. The members of the Commission are nominated by the Ministry of Agriculture except those representing private sylviculture who, in the first instance, are proposed by the Directing Council of the Forestry Society. The Chief of Station is a permanent member of the Commission and acts as president; he also acts as editor and is responsible for the accounts. With regard to the other members of the Commission, one member must be re-elected every two years.

The Commission meets once yearly at least. It settles the plan of work for the coming session and draws up the budget. It reports upon the work of the preceding session. It has the power to entrust the direction or execution of a piece of work to a person other than the Station Chief, although in cases where the nature of the work demands continuity it shall be the Station Chief who has preference. The Commission may consult technical men and invite them, if necessary, to attend their sittings, in cases where they are deemed specially competent to deal with some special question.

The Station expenses for the period 1902 to 1915 have increased from 11 530 to 19 450 francs distributed as follows:

1) Sittings of Commission; 2) Payment of 4 members of the Commission; 3) Payment of Chief of Station; 4) Payment of other persons conducting experiments; 5) Salary of assistant;

EXPERIMENTAL  
AND  
ANALYTICAL  
WORK

(1) See A. O., Forsøgsvæsendets af Ledelse, *Ibid.*, pp. 445-457 + 2 figs. (Ed.).



6) Daily pay and travelling expenses of Chief of Station; 7) Daily pay and travelling expenses of assistant; 8) Experiment grounds (regular); 9) Hegelund nursery; 10) Other trials conducted by Station Chief; 11) Other trials conducted by special men; 12) Postage, carriage, servants etc.; 13) Apparatus, books, office clerks etc.; 14) Publication of reports.

The Station for Forestry Research now has its office at Copenhagen, near the Higher School of Agriculture, and its Experimental Nursery (13½ acres) at Hegelund, 35 kilometres from Copenhagen. This latter possesses a little wooden building containing the workmen's quarters and an office.

Up to the present, the Station has published 4 volumes (1905-1915) of reports. Beginning with the 4th. volume the reports, printed in Danish, are accompanied by summaries in English, French and German. The following is a list of subjects dealt with up to the present.

Growth and yield of forest trees — Trials of foreign species — Researches on forests soils and particularly the forms of humus and soil biology — Mechanical and chemical analyses combined with trials on the application of artificial fertilisers to spruce, Scots pine, fir and oak in heath soils — The action of storms on forest trees — Races and forms of forest trees — Control of diseases of forest trees — Management, thinning and repopulating of beech — Manufacture and employment of wood for joinery and fuel — Easy and economic methods of mensuration of timber.

In view of future researches on the natural conditions of forests, the Station occasionally takes measures for the enclosure of single trees, of groups of trees and sometimes of large areas of wood.

Since 1902, the Station has belonged to the international organisation of Stations for forestry research, and has been represented at the meetings at Vienna (1903), Würtemberg (1906) and Brussels (1910).

## CROPS AND CULTIVATION.

SOIL PHYSICS,  
CHEMISTRY  
AND  
MICROBIOLOGY

619 — A Review of Investigations in Soil Protozoa and Soil Sterilization. — KOPELOFF, N., and COLEMAN, D. A. in *Soil Science*, Vol. III, No. 3, pp. 197-269. New Brunswick, N. J., March 1917 (1).

As there has been no adequate historical review of the literature dealing with soil sterilization and soil protozoology, with the exception of certain introductory briefs published in connection with investigations along one definite line or another, the writers considered it advisable to present a survey of the subject to date, not only as an introduction to the investigations to follow, but likewise as being of inherent value to the investigator pursuing specialized work along these and allied lines, and those whose interests may lead them into the field of soil fertility. The practice of

(1) See B. May 1917 and *passim*.

(Ed.)

sterilizing soils by heat, as well as antiseptics, has been the basis of no small amount of experimentation before the publication of Russell and Hutchinson's work. However, in view of the importance of the latter, it seemed to the writers desirable arbitrarily to divide the investigations into sterilization into two parts, the first treating of those prior to Russell and Hutchinson, and the second of those following. Again for the purpose of a more coherent résumé, soil sterilization may be considered under the two headings of sterilization by heat, and antiseptics, each of which may be further subdivided into three parts, namely: (a) the effect on the physical and chemical condition of the soil; (b) the effect on plant growth; (c) the effect on the biological activities.

From the review of the bulk of the literature dealing with soil protozoa and soil sterilization, it may be seen that, despite the work already done, comparatively little is known concerning the phenomena involved. Tracing the practice of soil sterilization by heat and disinfectants it is seen that beyond recognizing the fact that crops are increased by such treatment, and that the chemical composition of the soil undergoes an alteration, together with a profound influence on the biological activities, data of a definite and penetrating character are wanting. Among the varied theories advanced to explain the phenomena of soil sterilization briefly summarised in this paper the following demand serious consideration:

1. In KOCH's theory of direct stimulation it is maintained that increased crop production is a result of the physiological effect of the sterilizing agency in stimulating plant growth directly. While several investigators have confirmed Koch's conclusions, they are nevertheless not widely accepted at the present day.

2. HILTNER and STORMER's theory of "indirect" stimulation emphasizes the bacterial factor. These investigators maintain that there is a bacterial equilibrium in the soil which is altered by the introduction of sterilizing agencies. After the decimation of a vast number of bacteria has occurred, a marked development in numbers ensues, which is responsible for the additional available plant-food causing an increased crop yield. This theory has received the confirmation of many eminent investigators, and is still in vogue, although it hardly completely explains the phenomena observed.

3. LIEBSCHER's view is that soil sterilization may be regarded in the same light as a nitrogenous fertilizer. This is not worked out in very great detail, but finds corroboration in most subsequent investigations.

4. RUSSELL and HUTCHINSON's conclusions have been considered at some length and have been so frequently referred to that it suffices to say at this point that they contend that sterilization eliminates a biological factor (protozoa) which is one of the limiting factors in soil fertility. This view, although having a profound influence upon all research in this field, has not been accepted by the majority of investigators working along the same lines.

5. PICKERING attaches the utmost significance to an alteration in



the chemical composition of the soil and proves that this change is largely responsible for increased plant growth.

6. SCHREINER and his associates also emphasize the chemical aspect of the problem, and contend that biochemical factors induce a change in the organic matter of the soil, releasing certain beneficial and harmful compounds which change the fertility of the soil.

7. GREIG-SMITH and others adhere to the bacterio-toxin hypothesis which considers that toxins and nutrients of the soil are alone concerned with the changes that occur when soils undergo sterilization. In his latest paper GREIG-SMITH contends that the traces of antiseptic remaining in the soil are responsible for increase in bacterial numbers and activities.

It remains unquestionable that considerably more investigation must be carried out before any one of the above theories is accepted in an unqualified manner. Considering the province of soil protozoology in its entirety, it immediately becomes apparent that this science is in its infancy and is urgently in need of suitable methods for making accurate investigation possible. As media, 1 per cent hay infusion, 3 per cent blood meal solution and soil extracts have proved to be most generally accepted. In staining, picric acid (KLEINENBERG) and iron haematoxylin (DELAFIELD'S) are most highly recommended. The "Blutkörperzähl-apparat" and the loop methods are employed for counting. A consideration of the inter-relation of protozoa and bacteria in normal soil remains practically a virgin field, although what little evidence there is obtainable points to the probability that the protozoa limit bacterial activity under conditions especially favorable to protozoan development. Thus, the scope of unsolved problems is considerably broader than the investigations already carried to completion. How to sterilize the soil without altering its chemical composition is an important though baffling problem.

On the bacteriological side much can and needs to be done in determining the differences in the physiological efficiencies of the various groups of organisms in the soil and how they are affected by sterilization. Further, it is imperative to know what rôle the fungi play in soil fertility, and how they may be taken into consideration when it is desired to have bacteria or protozoa constitute the limiting factor. In addition to an improvement and discovery of methods in soil protozoology it is essential to know more of the life-habits of these organisms, especially as regards the effect upon them of environmental conditions such as (a) the physical and chemical conditions in the soil, together with the effect of (b) air; (c) light; (d) heat; (e) moisture, reaction, gases, etc., as well as the mutual association with other biological factors. Finally, a matter demanding immediate study is the actual observation of pure cultures of protozoa acting singly and collectively upon pure cultures of bacteria, thus furnishing some definite basis for the investigation of soil protozoa as a factor in soil fertility.

With the solution of these problems will come a more profound understanding of the science of protozoology, a science which bids fair to take



its place with soil bacteriology as furnishing a portion of the foundation essential for soil fertility investigations.

A list of 337 references to literature bearing on the subject is given in appendix.

620 - **The Relation of Protozoa to Certain Groups of Soil Bacteria.** -- HILLS, T. L. (Laboratory of Agricultural Bacteriology, University of Wisconsin) in *Journal of Bacteriology*, Vol. I, No. 4, pp. 423-433 Baltimore, 1916.

The writer has studied the effect of protozoa on certain biological processes of the soil : ammonification, nitrification, and free nitrogen fixation. For this study silt loam soil cultures were used ; the moisture content was maintained at as near one-half saturation as possible.

In the soil cultures the presence of protozoa under the conditions of the experiments did not have any noticeable effect, detrimental or otherwise, on the processes of ammonification, nitrification and free nitrogen fixation. In the case of the liquid cultures employed in the study of free nitrogen fixation the conditions were at an optimum for the development of the protozoa and under these circumstances they limited bacterial activity as evidenced by the harmful effect on the fixation of free nitrogen. Under these conditions the protozoa were undoubtedly active in destroying the *Azotobacter* cells. But in the soil cultures conditions were evidently not favorable for the activity of the protozoa as these organisms did not appear to exert any harmful influence on the three soil processes studied.

A bibliography of 6 references is appended.

621 - **New Irrigation-District Code for Oregon, U. S. A.** -- CUPPER, PERCY A. in *Engineering News-Record*, Vol. 78, No. 5, p. 254. New York, May 3, 1917.

The Oregon legislature has just enacted a complete irrigation-district code and repealed all laws on this subject hitherto existing in the statute books.

Under the new code the organisation of the district, which is a quasi-municipal corporation, is initiated by filing a petition with the County Court. If the Court approves, an election is called, landowners voting.

The district is governed by a board of 3 directors. The state engineer is required to approve or disapprove the plans prepared by a competent engineer appointed by the Board of Directors or plans adopted by the Board. Final payment to any contractor constructing the irrigation district works shall not be made until the constructed works have been approved by the state engineer.

Bonds of the irrigation district bearing not over 6 % interest may be issued to cover the cost of construction. The funds necessary for the payment of the expenses of the district, including the interest and principal on bonds, are raised by assessment on the lands according to benefits, levied in the same manner as state and county taxes are levied and collected by the county officials.

The issue of bonds is subject to the authorisation of the Attorney General, the state engineer and the superintendent of banks, who must first

PERMANENT  
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DRAINAGE  
AND  
IRRIGATION

be convinced that the value of the property to be irrigated and that of the irrigation works is equivalent to at least twice the amount of bonds issued.

622 - Summary of Researches by Messrs. MÜNTZ and LAINÉ on the Control of Irrigation according to the Physical Properties of Soils. — HITIER, H. in *Bulletin de la Société d'Encouragement pour l'Industrie Nationale*, 116th. year, 1st. half year, Vol. 127, No. 2, pp. 386-398. Paris, March-April 1917.

From 1905 to 1910 Messrs. MÜNTZ and LAINÉ were engaged upon a series of researches, conducted both in laboratory and field in various parts of France, on the capacity of soils to utilise irrigation water and the most favourable conditions of distribution of this water.

The writer points out the value of such a study and the importance of knowing how best to use and to draw the maximum amount of profit from the invariably limited amount of irrigation water. Unfortunately, death has interrupted the course of the work. The results already obtained, however, are of great importance and it is to be hoped that others will carry on the research.

Messrs. MÜNTZ and LAINÉ have shown that it is indispensable to include, among the preliminary plans of an irrigation scheme, a study of the physical properties and particularly of the permeability of the soils contained in the irrigation area. They have shown that, contrary to generally received opinion, soils even of similar geological formation show enormous differences among themselves in this respect. They conclude the account of their 1905 to 1907 experiments in the following manner:

Apparently, soils can be divided into 3 categories:

- 1) those which can be regarded as almost impermeable, that is to say in which the water only penetrates a few millimetres in an hour and which, consequently, are not capable of allowing water to penetrate in ordinary irrigation conditions. In the authors' opinion, therefore, these soils are only worth irrigation in quite special economic and technical conditions.

- 2) slightly permeable soils, which the water, in the ordinary conditions of practical irrigation, can penetrate at about the rate of 1 cm. per hour and which would be suited by light irrigations repeated more or less often.

- 3) soils which the water penetrates to a depth of a few centimetres or more and which may be regarded as permeable, that is to say readily absorbing water and meriting heavier irrigation. Above a certain degree of permeability there is no longer any object in determining the exact degree to which the soils belong in the scale. Such soils are all capable of absorbing sufficient water. At this point there intervenes the determination of the amount of water actually useful to vegetation in order that it should be just this amount which is administered and not the undoubtedly greater quantity that such soils are capable of absorbing.

After 1908, Messrs. MÜNTZ and LAINÉ gave their researches another trend, devoting their chief attention to organising irrigation tests in different localities and in different classes of soils in order to discover the method of irrigation which gives the best effect on the crops.



*Practical value of such researches.* — The experiments made in the district of the Bourne Channel (Department of the Isère) show the practical scope of such researches. The Bourne channel, the Bourne being a tributary of the Isère, waters the plain situated on the left bank of the Rhône, to the south of the junction of this river and the Isère. The soils of this region are extremely permeable. According to the scale of Messrs. MÜNTZ and LAINÉ (1) this permeability varies from 30 to over 150, whilst soils of average permeability have an index varying from 5 to 20.

The water is led on to the land through narrow trenches which are dammed in order to make them overflow. When, as in the case in question, the permeability is very great, the process of infiltration is extremely rapid and unless the overflow is of considerable volume it only reaches the points closest to the trench. It then happens that a portion of the plots derives no benefit from the irrigation, whilst the soil near the trench is washed out by an excess of water; the soluble fertilising elements are carried off into the subsoil and are lost to the plants, whence the paradoxical result: the irrigation diminishes the fertility.

Further, the head of water supplied to the user at the highest point of his property is too small for the canal in question, with the result that in view of the permeability of the soil, the speed of the water is insufficient to allow of its reaching points any great distance away. The water is also too clear to allow of the permeability being diminished by means of the deposit of matter in suspension.

Good results may be obtained from the irrigation, however, if, in spite of the small water supply, sufficient rapidity can be imparted to the flood water to allow of the plot's, if shortened, receiving water over its whole surface without the land around the supply trench receiving an excess.

*Permeability of soils and their capacity to benefit by irrigation.* — The best results have invariably been obtained in soils of average permeability.

When contemplating an irrigation project, a study of the physical properties of the soil is absolutely indispensable and it is particularly necessary also to determine the quantity of water permeating in a given time.

When this is done, soils may be classed in two great categories:

1) those possessing a degree of permeability corresponding to the two extremes of the scale; these extremes forming exceptions though occurring fairly frequently;

2) soils of average permeability.

In these latter, irrigations regulated according to the degree of permeability give remunerative results, that is to say barring exceptions independent of the nature of the soil.

In the case of the former, on the contrary, success is uncertain and before preceeding with the project it must be first considered whether the increase in yield is likely to be such as to compensate for the expense, which may necessarily be considerable. In soils of low permeability, in which the

(1) Each degree of the scale constructed by Messrs. Muntz and Lainé corresponds to a 1 cm. layer of water permeating in an hour.



water penetrates at the rate of 1 to 2 mm. per hour, it may be advisable to anticipate a careful arrangement of the land: regular slopes with sufficient drop which would not allow any surplus water to remain on the land, and sometimes even draining. In highly permeable soils in which the water penetrates at the rate of more than 40 to 60 cm. per hour, expenses may be equally high, especially with exaggerated wages to labour.

With these extreme types of land, when channels already exist it is advisable to turn them to account as much as possible.

In the case of very permeable soils a big volume of water is required at the head, the rapidity of the irrigating water being increased and the land divided into plots of small area.

For soils classed at the other end of the scale, the pressure of water at the head should be just sufficient, thus allowing the section of the laterals to be reduced; the speed of the irrigation water should then be reduced and the length of the plots increased.

*General results of 1908, 1909 and 1910 experiments.* — The quantity of water supplied by the irrigation is expressed by what is known as the *débit continu* (continuous supply). This is the volume of water given during the growing period related to an area of 1 hectare (2.4711 acres) and a time-period of 1 second.

The *débit continu* is the resultant of 3 dimensions:

- 1) The pressure at which the water is supplied to the plot by the ultimate branchings of the channel.
- 2) The duration of each irrigation.
- 3) The period elapsing till the next irrigation.

The experiments of Messrs. MÜNTZ and LAINÉ were conducted in order to fix these data. They were only concerned with natural meadowland irrigated by the flooding method. The experimental fields varied as widely as possible both as regards nature and permeability of soil. Both the volume of water and the intervals between irrigations were made to vary and the influence of such variations on the crop yield determined.

The experimental fields were classed as follows according to the authors' own scale:

	Permeability
Fourcadel . . . . .	0.5 to 0.1
Ondes . . . . .	0.6
Cheval-blanc (near Cavaillon) . . . . .	2.0
{ Pernes-Garrigue . . . . .	3.0
Carpentras    { Carpentras-Terradou . . . . .	10.0
{ Hèrnes-Croix-Couverte . . . . .	12.0
Valence . . . . .	50 to 60

The following data were determined in each field:

- 1) the "module" or head of water at highest point of property;
- 2) the quantity of water which had the most favourable effect upon the crop yield, with irrigations at identical intervals;

3) The influence on the yield of a same total quantity of water distributed in smaller or greater amounts at more or less frequent intervals.

I. *The "Module"*. — The "module" (head of water at highest point of property) is equal to the product of the volume of the flood water and the width of the plot to be flooded.

The volume and speed of the flood water should vary between wide limits according to the rapidity with which the water penetrates, and should increase with the increase of this latter. The experiments have shown that, in very slightly permeable soils, like those of Fourcadel or Ondes for example, the "module" should be such that the capacity of the irrigation flood should be about 0.30 of a litre per metre of width per second; in soils of average permeability, as at Carpentras, it should be equivalent to a capacity of 1.5 to 2 litres per metre, per second; in lands of extreme permeability, such as those watered by the Bourne channel, it should exceed 9 litres per metre, per second.

In order to water more rapidly and to diminish labour the beds should be given the maximum width, still this width must not be exaggerated, otherwise it will make regular distribution of the water difficult.

II. *Quantity of water to be distributed at each flooding*. — The trials have shown that the amount of water to be employed should be just sufficient to allow of its reaching the extremity of the bed.

A quantity of water in excess of this represents a loss and might be employed for watering other surfaces; it might also be actually harmful owing to its washing out the soil and carrying off nutrient matter. If, in some cases, more plentiful watering gives a slight increase in the crop yield, this increase is not proportional to the extra cost of the water.

III. *Intervals between floodings*. — Generally speaking, the best results are obtained with irrigations repeated every 7 or 8 days.

Floodings at very close intervals often give an increased crop but this increase is neither sufficiently uniform nor important to compensate for the extra cost of labour.

Floodings at intervals of a fortnight and, especially of 3 weeks, give markedly inferior results.

*Water supply*. — Hitherto it has been held that the normal supply should be equivalent to 1 litre per hectare per second, for all lands. Messrs. MÜNTZ and LAINÉ have now found that, varying with the nature of the land, the correct supply should be as follows:

Fourcadel	0.23 litres	instead of	0.75 litres	as fixed by agreement
Ondes	0.54	"	"	0.75 " not fixed
Cavaillon	0.55	"	"	0.75 " not fixed
Carpentras	0.71 to 0.85	"	1.275	" as fixed by agreement

This proves that wastage usually occurs.

Messrs. MÜNTZ and LAINÉ add that the ideal irrigation would be one which supplied the soil with the quantity of water strictly necessary to obtain a maximum crop. In experiments at the Meudon Station of Plant



Chemistry, the amount of water evaporated which corresponds to 1 kg. of dry crop, never exceeded 550 litres. According to this, there would be required for the plus crop values obtained by irrigation, the following quantities of water.

		Plus-value of crop	Quantity of water	
			evaporated by the crop, cubic metres	usually given, cubic metres
Stations	Fourcadel . . . . .	2 700	1 485	5 880
	Andes . . . . .	3 500	1 925	3 500
	Carpentras . . . . .	10 000	5 500	20 700

The quantities usually given are consequently greatly exaggerated. One must take into account, however, that an irrigation channel must respond to the calls made upon it at times of greater drought. If a fresh calculation is made for a second crop (aftermath) during a similar period, the following figures are obtained :

		Plus value furnished by the irrigation kg.	Number of floodings	Volume of water per flooding	
				usually given, cubic metres	utilised by the plant, cubic metres
Stations	Fourcadel . . . . .	2 200	6	490	202
	Ondes . . . . .	2 225	4	500	306
	Carpentras . . . . .	4 330	8	830	298

These data, though of a somewhat abstract character, show that the real water requirements are markedly exceeded in practice. Although it is impossible to obtain the ideal quantity in practice nevertheless efforts should be made to approximate to it.

623 - **A Modified Method of Green-Manuring.** — HUTCHINSON, C. M. (Imperial Agricultural Bacteriologist) in *Bulletin No. 63, Agricultural Research Institute, Pusa*, 12 pp. Calcutta 1916.

It has been noticed that the complete decomposition of a green crop depends upon the incidence of rainfall following its burial. This fact has suggested the avoidance of negative results from green-manuring by carrying out the initial stages of decomposition under artificial conditions.

It has been found that the most complete breaking down of plant tissues was obtained by providing an excess of moisture accompanied by anaerobic conditions during the first stage, followed by a second one of less moisture and semi-aerobic conditions. The main object is to cultivate conditions favourable to the development of the class of organisms whose specific function is the breaking down of the cellulose walls and middle lamella and whose absence in aerobic conditions indefinitely prolongs decomposition.



An example of such conditions is afforded in connection with the indigo industry. During extraction of the indigo in the factory the plant is partly fermented in water and partly in heaps after removal from the vat. The resulting product is a partly decomposed mass of vegetable tissue which possesses high manurial value. When this is taken directly to the land the greatest effect is not seen until the following season, whereas when allowed to remain in heaps for a further period of several months its action is rapid and immediate. Obviously, any green crops will give comparable results when so treated in proportion to their relative nitrogen content. Apart from the provision of nitrogenous food, however, the production of humus is also important so that it may pay to treat crops of low nitrogen content in the same way.

The following is an account of the method used by the writer but he wishes to lay down no hard and fast rules. Obviously, modifications can be introduced to suit local conditions. His principal object is to invite criticism and suggestions.

*The method.* — Borrow pits were dug at the sides of the field previous to cutting the green crop, this being done during the rains, the pits filled with water; the cut crop (*Crotolaria juncea*) was placed in the pits, left there for periods varied experimentally from 24 to 48 hours, removed from the pits, stacked in heaps and allowed to ferment for varying periods of time, after which the rotted manure was applied to the soil (1).

It was at first found necessary to water the heaps occasionally to avoid drying out, but this was subsequently avoided by plastering their outside with clay, comparatively small quantities of water being occasionally applied to prevent cracking of the latter.

Further modifications of this method were adopted subsequently; in order to avoid loss of nitrogen as ammonia, the water remaining in the pits was dug out and made into alternate layers with the green manure in the heaps. As large quantities of ammonia pass into the water during fermentation the smallest possible quantity of water should be used so as to make it possible to utilize the whole of it for moistening the heaps.

It was found that more complete fermentation could be obtained by inoculating the heaps with impure cultures of cellulose destroying bacteria obtained simply by making a water extract of fresh cowdung.

Manurial experiments with Sann hemp (*Crotolaria juncea*) fermented in this manner have been made upon the oat and tobacco crops and have given very favourable results.

*The advantages of the method* may be summarised as follows:

- 1) In case of the failure of the autumn rains and consequent lack of moisture in the soil the manure can be held over till the following crop.
- 2) The improved method of rotting the manure will enable the

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(1) Later experiments seem to show the advisability of omitting the preliminary steeping in water (owing to loss of nitrogen) and of commencing the preparation of the fermented manure by stacking in heaps, moistening with water, and allowing fermentation to proceed as before. (Author's note).

grower to postpone the cutting of the crop and thus obtain a much larger bulk of manure.

3) The possibility of applying larger and consequently more paying quantities of the manure per acre.

4) The application of the manure in a better digested form will increase the amount of *available plant food* at an early stage of growth of the succeeding crop.

The method should also be capable of application to the decomposition of the residues of other crops: stools of sugarcane for instance. These stools contain a considerable amount of saccharine matter and should form an excellent medium for bacteria.

624 - **The Trade in Nitrogenous Materials.** — I. BERTRAND A. (Inspector Fiscal de la Propaganda Salitrera), Industria y Comercio de substancias azoadas, in *Anexo al Boletín No. 8 de la Asociación Salitrera de Propaganda* pp. I-XV + 1-155. Santiago-Valparaíso, 1915. — II. IDEM, Una presentación grafica de la Historia Económica del Salitre en los últimos veinte años, in *Asociación salitrera de Propaganda, Circular Trimestral No. LXVII (Boletín No. 8)* pp. 3-5 + diagrams, Valparaíso, October 1915. — III. IDEM, Factores del Futuro Mercado Salitrero, *Ibid.*, No. LXVII (*Boletín No. 10*), pp. 180-187, December 1915. — IV. IDEM, Nuevas previsiones acerca de las condiciones económicas de Producción de la Salitre de Chile y demás substancias Azoadas, *Ibid.*, No. LXVIII, pp. 68-84, March 1916. — V. IDEM, Extension, Riqueza y Duración Augurada a los Yacimientos Salitreros de Chile, *Ibid.*, No. LXX, pp. 22-28, July 1916. — VI. IDEM, Conferencia dictada en la Semana de la América Latina en Lyon, el 4 de Diciembre de 1916 *Ibid.*, No. LXXI, pp. VI-XV, December 1916.

I. — In his continuation of the series of memoirs (29) already published dealing with the various aspects of nitrogen, the writer now deals with the subject as it appears in the light of new discoveries and international events. The 1st. chapter summarises the chief nitrogenous substances, their methods of application and the industries which may be practically regarded as deriving therefrom.

On examining the nitrate of soda industry in Chili, one sees that the average price at the factory, in September 1914, was 8.80 francs per 100 kilograms, equivalent to 0.60 fr. per kilogram of nitrogen. The number of factories in operation at the same time was 166, distributed irregularly over an area of 2317 sq. miles, and their annual production capacity was 2 000 to 125 000 metric tons, the maximum production being capable of reaching 50 000 to 100 000 tons, which means the total amount available over 15 years was 800 000 to 1 500 000 tons. The costs of working a nitrate deposit are estimated at 26 to 52 fr. per ton.

The actual value of the nitrate deposits now being worked in Chili, without reckoning depreciations, is 175 000 000 fr. The total capital concerned, not only in the deposits but also in the industry itself with its various branches, may be estimated at 750 000 000 to 950 000 000 fr.

The export value, 2 500 000 tons at 8.80 fr. f. o. b. per Spanish quintal (46.02 kg.) is equivalent to more than half the capital engaged. In this connection, however, it must be remembered that in 15 years the deposits of nitrate of soda may be exhausted. Of the capital engaged about  $\frac{1}{3}$



is Chilian,  $\frac{1}{3}$  English, and the remainder is divided among Germany and other countries; the English companies, which are the most important, have paid annual dividends varying from 8 to 20 %. Since 1883, the Chilian Government has collected, in the form of a tax on export, a total of 2 750 000 000 fr. and, since 1903, the concession dues have brought the Government in another 75 000 000 fr.

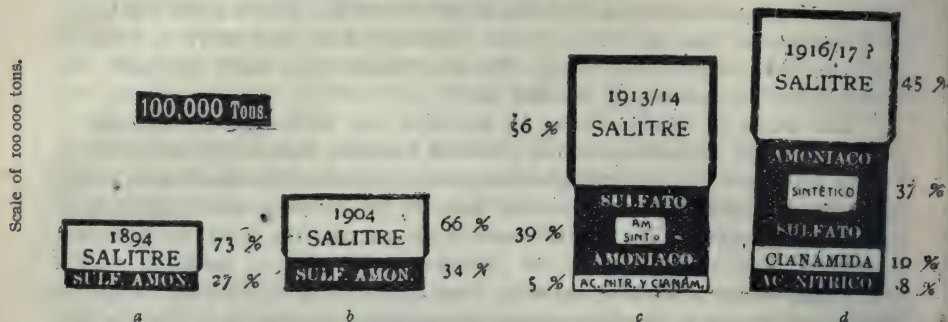
The trade in nitrate being an overseas one with remote markets, it depends: a) on variations in the price of freights, this being accentuated by the fact that the producing country has no mercantile fleet of its own; b) on the fact that, once the product has left the country, the conditions of sale are no longer within the influence of the producers; c) on the fact that payments are made drafts on London, viz: in a medium which is not that of the producing country, thus introducing an element of speculation and unrest. Another cause of instability is the fact that, in the Northern Hemisphere, nitrate of soda is employed chiefly as a spring fertiliser, which results in  $\frac{3}{4}$  of the amount exported to Europe being consumed in 4 months, while in the 5 months from July to November only  $\frac{1}{5}$  or  $\frac{1}{6}$  is consumed; on the other hand, the production must be continuous and uniform: whence a constant increase of stock in hand, aggravated by the difficulty of keeping the nitrate, and fresh ground for speculation. The result is that the nitrate of soda from the time of its leaving Chili till its arrival in the hands of the farmers who use it increases in price over 100 %, and this without taking into account a fluctuation of 10 to 15 % due to speculation. And while the producers' organisation, by means of propaganda, has aroused the demand for nitrate of soda, it has left to others the task of satisfying this demand.

The writer next examines the following industries: ammonium sulphate derived from coal — nitric acid (electric arc) and its derivatives — calcium cyanamide — synthetic ammonia — nitrification of aluminium — other processes (OSTWALD, HAUSSER, BENDER, WOLTERECK, MOND) of electric oxidation and of synthesis of ammonia. On examining the degree of competition among the various products it results that the strongest competitor of Chilian nitrate will be the German output of nitrogenous material, there being less interest in producing these substances in Great Britain, France, Spain and Italy. The writer draws attention to the fact that the OSTWALD process for the transformation of ammoniacal nitrogen into nitric acid does away with a great deal of the importance of the distinction between the market for nitric nitrogen on the one hand and that for ammoniacal nitrogen and cyanamide on the other. He concludes, eventually, that one must take into consideration on the one hand the continued efforts made in order to reduce the price of the unit of nitrogen, and on the other, the geographical and economical factors which favour the concentration of the nitrate of soda industry in Chili.

The article concludes with a series of 33 supplementary notes (explanatory, statistical etc.) and 4 appendices dealing with: the terminology of nitrogenous materials — organic nitrogenous fertiliser — encouraging the production of nitrogenous substances — the nitrogen monopoly projected in Germany.

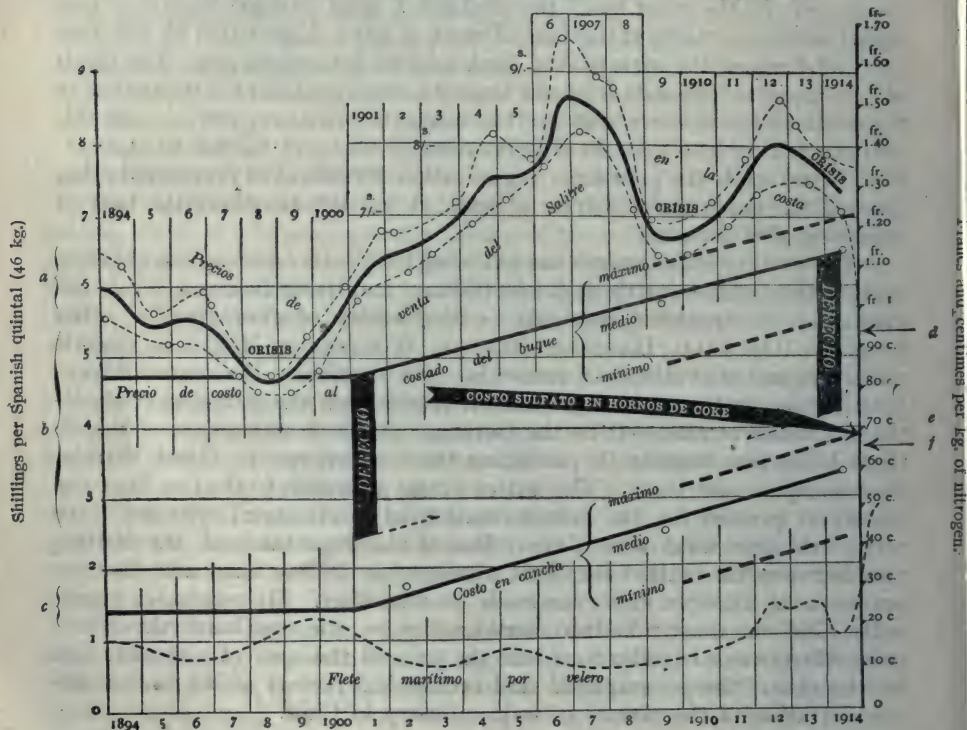


*Progress in the production of various nitrogenous materials,  
calculated in English tons of nitrogen.*



a = production of nitrogen from nitrate of soda and sulphate of ammonia in 1894; b = the same in 1904; c = production of nitrogen from: nitrate of soda, sulphate of ammonia by distillation and by synthesis, synthetic nitric acid and calcium cyanamide in 1913-14; d = the same in 1916-17.

*Selling price and cost of nitrogen during the period 1894-1914.*



a = ---o--- selling price of nitrate of soda at Chilian coast; — average price *id. id. id.*  
b = — average annual cost of nitrate of soda at quay-side; --- maximum and minimum; *derecho* = export dues.  
c = — average annual cost of nitrate of soda at the factory; --- maximum and minimum; --- freight Europe, sailing ship.  
d = cost of Norwegian nitrate (of lime); e = cost of sulphate of ammonia from coke furnaces; / = cost of synthetic ammonia and of calcium cyanamide.

II. — The 2nd. article describes by means of graphs, which we reproduce herewith, the economic history of nitrate of soda and other nitrogenous substances during the last 20 years.

The graph portrays the following facts :

- 1) The increase from year to year of the world's production of combined nitrogen.
- 2) The proportional increase of sulphate of ammonia in relation to the total production of combined nitrogen.
- 3) The important place which, according to likely data, will be taken by synthetic nitrogenous substances in the production of combined nitrogen, at the end of the present war.

III. — In a 3rd. article on the condition of future markets, the writer gives data confirming his earlier forecast of the principal competitors in the nitrate of soda industry and makes special reference to the Report presented to the German Reichstag by the Commission on the nitrogen monopoly.

IV. — The 4th. paper gives fresh forecasts on the economic conditions of the production of nitrate of soda and of other nitrogenous substances in Chili. The following facts are brought out :

- 1) The recovery of nitrogen from coal (for which possible increase in output, and reserves constitute a margin of production 25 times as great as the maximum available in the nitrate of soda deposits) is progressing in a manner relatively superior to that of nitrogen in the form of nitrate of soda.
- 2) The first synthetic nitrogenous products (nitrolim and calcium cyanamide) up till 1912, only made slow progress, whilst the production of synthetic ammonia (HABER process) suddenly became of commercial importance in 1913, by giving financial results which up till May 1914 were regarded as safe in competent circles.
- 3) The war has obliged Germany (and this state of affairs will continue) to nationalize the production of nitrogen in order to render herself independent of outside sources in all circumstances whatever, and the prolongation of the war will strengthen this important industry more and more every day.
- 4) The present war, without rendering the production of nitrogenous substances obligatory in other countries, who are or will be big consumers, has shown the advantage which a country has in producing these substances itself.

An appendix gives tables constructed with the coefficients of the International Institute of Agriculture, which allows of the conversion to unity of the prices of nitrate of soda and of sulphate of ammonia.

V. — The writer discusses the data relative to the extension, wealth, and probable life of the Chilean nitrate of soda deposits, concluding that there exist in the country, at the present moment, 200 million tons of utilisable nitrate of soda, i. e. capable of being extracted at an average price (at the deposit) of 3.75 fr. per Spanish quintal (46.02 kg.), equivalent to a minimum content in the mineral treated of 10 % of nitrate of soda ; but this estimate does not include unexplored deposits.

VI. — Finally, in the text of the discussion cited at the close, the writer explains that the kilo of nitrate of soda delivered in Europe is calculated as follows ;



Price at deposits, labour, fuel and depreciation . . . . .	0.48 fr.
Carriage to Chilian coast, commission : . . . . .	0.11 »
Export dues . . . . .	0.41 »
Freight, insurance and commission . . . . .	0.30 »
	<hr/> 1.30 fr.

If the cost of production were reduced by means of installations on a large scale, the amount of commission paid diminished by 2 % by centralising the sale, and freight and insurance lowered by 3 % by means of direct consignments, it should be possible to produce a kilo of nitrate of soda at a French port at the following price.

Cost of production . . . . .	0.39 fr.
Carriage to coast . . . . .	0.09 »
Freight, etc . . . . .	0.27 »
	<hr/> 0.75 fr.

The price of the metric ton of nitrate of soda at 95 % i. e. containing 155 kg. of nitrogen, would thus be less than 120 fr. at a French port.

The quantity of nitrate of soda utilisable in Chili being 200 million metric tons, this country would be able to put on the world market 3 million tons of nitrate every year for 70 years. Allowing, however, an annual increase in production of 55 000 tons (this figure being based upon past years) the end would be reached in 1966. In these calculations no account has been taken of unexplored deposits, the capacity of which is estimated by competent persons as being certainly 4 to 5 times that of the deposits already in working or explored.

625 - **The Effect of Weeds upon Cereal Crops.** — BRENCHELEY, WINIFRED E. (*Rothamsted Experimental Station*) in *The New Phytologist*, Vol. XVI, Nos. 3 and 4, pp. 54-76. London, March and April 1917.

The practical results of the competition of weeds and crops are well known, but the exact cause of this competition is less obvious. It is common knowledge that the weeds utilise food and water from the soil and, above ground, tend to rob the crop of much of the sunlight essential to full development. Apart from this, however, it has often been questioned whether the weeds may not excrete from their roots some poisonous substance which actually inhibits the growth of the crops, but the whole matter is very undecided.

The present paper gives the results of pot and water-culture experiments carried out at Rothamsted over a period of 4 years with crops and weeds grown in association. The following combinations were tested, the conditions being varied as far as possible to imitate natural conditions except that the pots were protected from birds.

The pots with wheat or weed alone received twice as much seed as was sown in the mixed pots; i. e. two parts of wheat or weed when alone and one part wheat + one part weed when mixed.



I. — POT EXPERIMENTS *Papaver Rhoeas* + *Papaver Rhoeas*, *Papaver Rhoeas* + Wheat, Wheat + Wheat, Wheat + *Alopecurus agrestis*, *Alopecurus agrestis* + *Alopecurus agrestis*, *Brassica alba* + *Brassica alba*, *Brassica alba* + Wheat, Wheat + *Spergula arvensis*, *Spergula arvensis* + *Spergula arvensis*.

II. — WATER-CULTURE EXPERIMENTS. Wheat + *Spergula arvensis*, Wheat + *Alopecurus agrestis*.

The conditions and results of the various experiments are set out in detail, the total dry weights of the resulting crops of cereal and weed being given in each case. The conclusions are as follows :

There is no evidence, and indeed no indication, that any direct toxic action comes into play.

It is evident that the mere competition of plant with plant, irrespective of species, has much to do with development and that the time and duration of competitive check are the chief factors involved. Purely vegetative competition is more potent than is generally realised. In the experiment all the crop plants were at least 4 or 5 inches apart, and the effects of overcrowding were most obvious. In a field where weeds are at all prevalent, the plants are still more closely placed, and the struggle must be still keener. Even when the weeds are suppressed by cultivating and hoeing, the roots remain in the soil to a large extent, and those of the perennials at least continue functioning in a normal way, though to a less degree ; nevertheless, such suppression of weeds is all to the advantage of the crop, owing to the removal of the aerial competition.

The vital factor in competition is the mere presence of other plants, be they what they may, and, up to a certain limit, two plants cannot make such good individual growth in a given restricted area as can one plant.

In those cases where the same soil was allowed to serve for experiments in successive years a comparison of the dry weights, pot for pot, did not show any evidence that the crop obtained from any individual pot in the first year in any way affected that obtained in the year following. This is a further proof of the absence of toxic effects from the roots. If toxins had been present a pot which carried a relatively small crop in 1915 might have been expected to carry a relatively large one in 1916 and vice-versa, as the large crop would have left a larger supply of toxin in the soil. As no such correlation was proved it seems evident that no toxin capable of remaining unchanged from one season to the other was present in the soils.

626 — **Assimilation of Iron by Rice from Certain Nutrient Solutions.** — GILE, P. I. and CARRERO, J. O. (Porto Rico Agricultural Experiment Station). *Journal of Agricultural Research*, Vol. VII No. 12, pp. 503-528. Washington, D. C., 1916.

It has long been recognized that on calcareous soils certain plants do not make a normal growth and are often affected by chlorosis. This has been variously ascribed to the physical condition of the soil ; an increasing assimilation of lime by the plant ; a diminished assimilation of all mineral nutrients due to the neutralization of acid root excretions. Previous

work at the Porto Rico Agricultural Experiment Station with pineapples and upland rice indicated an insufficient assimilation of iron as the principal cause. As calcareous soils have a slightly alkaline reaction, and as it is important to know whether plants intolerant of calcareous soils are sensitive to an acid or alkaline reaction *per se*, and whether the reaction of the soil has any effect on the assimilation of iron, further experiments with upland rice (*Oryza sativa*) in nutrient solutions and soil cultures have been conducted.

The experiments with nutrient solutions reported show the effect of the quantity and form of iron and reaction of the nutrient medium on the assimilation of iron by rice. In nearly all cases growth was much better in the nutrient solutions employed with 0.008 gr. of iron per litre than with 0.002 gr. When judged by the growth of plants, ferrous sulphate, ferric citrate, and ferric tartrate afforded sufficient iron when used in proper quantities in the acid and neutral solutions. Ferric chloride was an inferior source of iron, and dialyzed iron utterly inadequate. Only ferric tartrate furnished sufficient iron in the alkaline solution. Plants grown in the acid solutions contained the highest percentages of iron. Plants grown in the neutral solutions contained higher percentages of iron than those grown in the alkaline solutions when some forms of iron were used, but equal percentages when other forms of iron were used. The percentages of nitrogen, phosphoric acid, lime, magnesia, and carbon-free ash in plants grown in six different solutions did not vary appreciably when compared with the iron content. It was evident that rice was not particularly sensitive to the reaction of the solution, except as the reaction influenced the availability of the iron. This substantiates previous work in showing that lime-induced chlorosis is caused by a lack of iron and indicates strongly that the only action of carbonate of lime in inducing chlorosis lies in diminishing the availability of the iron. The amount of available iron in the different solutions could not be determined analytically, because of the impossibility of distinguishing between colloidal and soluble iron. Calculations showed, however, that the concentration of available iron in many cases must have been less than one part in 10 000 000 of solution.

Reference is made to the bearing of these results on the proper composition of plant nutrient solutions.

Abibliography of 15 works is appended.

PLANT  
BREEDING

- 627 - Pollination and Cross-Fertilization in the Juar Plant (*Andropogon Sorghum*, Brot.). — DOUGLAS, GRAHAM, R. J., in *Memoirs of the Department of Agriculture in India, Botanical Series*, Vol. VIII, No. 4, pp. 201-216, XII figs. + 2 plates. Calcutta, December, 1916.

In successive generations of hybrids of "juar" (*Andropogon Sorghum*, Brot.), certain characteristics, such as the colour of the grains and the shape of the glumes, divide and re-combine according to Mendelian laws, in the most simple manner.

1) COLOUR OF THE GRAINS. — The crossing of a red plant (RR) with a white one (rr) gives, in the 1st. generation ( $F_1$ ) a red hybrid without interme-



diante colour which produces 4 kinds of gametes: — **RR** (red) — **Rr** (red) — **rR** (red) — **rr** (white). In the 2nd. generation ( $F_2$ ),  $\frac{3}{4}$  of the plants should be red, and  $\frac{1}{4}$  white, according to the ratio 3 : 1. The actual ratios obtained were 3 : 1 and 2.2 : 1, which correspond exactly with the theoretical calculation.

The cross between *red*  $\times$  *yellow* gives similar results, with dominance of the red to the yellow. Of 126 plants of  $F_2$ , 94 were red and 32 white, according to the ratio 2.9 : 1, which is very near to the theoretical ratio 3 : 1.

The results obtained in the series *yellow*  $\times$  *white* were much the same as those for *red*  $\times$  *white* and *red*  $\times$  *yellow*, with dominance of the yellow over the white. Thus, of 16 plants of  $F_2$ , 12 had yellow grains and 4 white grains, in exact accordance with the ratio 3 : 1. In some cases, however, individuals appear in  $F_1$  whose progeny in  $F_2$  is a mixture of white, red and yellow grained individuals. In such cases it seems clear that the white contains a determinant of the red, which, however, exists in the latent state and is only capable of developing in the presence of the yellow. The hybrid of  $F_1$  with formula **Rr Yy**, heterozygous to 2 characteristics, produces 4 kinds of gametes: — **RY** — **Ry** — **rY** — **ry**, capable of giving, in  $F_2$ , 16 different combinations, of which 9 should be red, 3 yellow and 4 white, as shown in the table below :

*Constitution of the hybrids of  $F_2$ .*

		Male gametes of $F_1$			
Female gametes of $F_1$	♂	RY	Ry	rY	ry
	♀				
	RY	RRYY	RRYy	RrYY	RrYy
	Ry	RRYy	RRyy	RrYy	Rryy
	rY	RrYY	RrYy	rrYY	rrYy
	ry	RrYy	Rryy	rrYy	rryy
Constitution of the hybrids of $F_2$					

The experimental values found are in accordance with the theoretical ratio 9 : 3 : 4 between red grained, yellow grained and white grained hybrids.

2) LENGTH OF THE GLUMES. — The "long glume" and "short glume" characters act as a pair of allelomorphs with dominance of the "short glume" character. Of 80 plants of  $F_2$  resulting from a cross between these two characters, 60 had short glumes and 20 long glumes, that is to say, they followed exactly the theoretical ratio 3 : 1.



As the specific behaviour of each of these factors (red, yellow or white colour of the grains; long or short glumes) is known, it is easy in each case, by applying the laws of the division and re-combination of the characters, to foresee the composition of the progeny of any hybrid of *Andropogon Sorghum* Brot, so far as the characters studied in this paper are concerned.

628 - **Potato Selection Experiments in Germany.** — WACKER, H., in *Zeitschrift für Pflanzenzüchtung*, Vol. IV, Part 3, pp. 267-302. Berlin, 1916.

Since 1908, the writer has carried out a series of potato selection experiments at the seed selection Institute of the Higher School of agriculture at Hohenheim (Württemberg). The object was to form new kinds of potatoes for Southern Germany so as to replace those cultivated so long in the country but now degenerate. The method was to be by sexual reproduction *with or without* hybridisation. The first was carried out by crossing two varieties and sowing the hybrid seeds thus obtained, the result being new potato plants. The sexual reproduction without crossing was carried out by choosing well developed berries of pure varieties and then continuing to select the plants from the seed obtained thus (1).

The culture of the progeny of the seedlings was always carried out by the method of individual selection in the 2nd. and 3rd. generation, so that the corresponding hereditary characters could also be studied. Less importance was attached to this method during the following generations, when the identity of the descendants of a family could be determined with precision. After the second generation the potatoes were grown with the ordinary spacing of 20 × 24 inches.

#### SELECTION OF POTATOES OBTAINED FROM THE SEED OF VARIETIES NOT ARTIFICIALLY FERTILISED.

In the first experiment made from 1907-1912 with the varieties : Nolcs Sämling, Münchinger, Alma, Rekord, Modell, Bohun, Fürstenkrone, De Wet, Bojar, Eva, Switez, Diana, the berries were gathered in the autumn of 1907 and sown on March 27, 1908 ; lifting was carried out 17 to 19 days later. The plants continued to grow normally. Transplanting was finished by the middle of May, and by the 30th. of the same month, all the seedlings were planted out in the open field. The tubers obtained showed fairly large variations as regards shape, size, colour, arrangement of the eyes, etc.

However, to continue the selection in the following years, only tubers of the varieties Münchinger, Nolcs Sämling, Bohun were chosen, and were selected till 1912. In that year an experiment was made to determine the comparative value of the 3 varieties.

This experiment showed that, for the Münchinger variety all the selections of the parent form had given negative results, and they were therefore abandoned.

(1) These operations, as well as the cultivation of the seed plants were usually carried out according to the way described by FRUWIRTH in his work : *Züchtung der landwirtschaftlichen Kulturpflanzen*, Vol III, pp. 32 and onwards. Berlin, 1910. Parey.

The Bohun variety did not give satisfactory results, the parent form having given bigger yields in tubers than the forms grown from the seed. Selection of this variety was discontinued, as was later done with the Nolcs Sämling variety.

In a second experiment (1909-1912), the varieties Agraria, Alma, Münchinger and Switez were selected. The seeds were gathered in the autumn of 1908 and sown on March 23, 1909. The plants grew normally, and were replanted on April 28 and 29, being planted in the open field on May 26. With the exception of plants grown from seed of the Agraria variety, which were weakly, all the plants developed normally during the summer. The former were abandoned the first year, while the latter were grown during successive years, during which they were subjected to individual selection. There was usually an appearance of uniformity among the plants of the same selection, but there were also considerable differences. The Alma variety was eliminated in the second generation, as was the Switez variety in the third, only the Münchinger variety being left. The plants of the latter variety gave, in the fourth generation, a much higher yield than the parent forms. Nevertheless, the yields were found to be too low, so the selection of this variety was also abandoned.

In a third trial, the writer used "Unterländer Wurstkartoffel", a variety chiefly grown between Stuttgart and Heilbronn, and considered very good. The berries were collected in the autumn of 1910 and sown in the following spring. The growth of the first generation plants, in 1911, did very well; plenty of well developed tubers of a yellow or red colour were obtained. For the selection of the second generation, 71 plants with red tubers and 36 with yellow tubers were chosen. However, the results were not satisfactory, and it was possible to continue the selection of a few strains only. The third generation gave very bad results. For this variety as well as the preceding ones, the method of sexual reproduction without crossing has not proved of value.

#### ARTIFICIAL CROSSING OF SEVERAL VARIETIES AND SUBSEQUENT SELECTION OF THE DESCENDANTS.

The following crosses were made:

- 1) Switez ♀ × Münchinger Original ♂
- 2) Switez ♀ × 2nd. generation Münchinger plant
- 3) 2nd. generation Münchinger ♀ plant × 2nd. generation Nolcs Sämling ♂ plant.
- 4) 2nd. generation Münchinger ♀ plant × Münchinger, Hohenheimer Nachbau ♂.

Artificial pollinisation was easily carried out.

The writer considers the cross between Switez and Münchinger as of the most importance, as is shown by the large number of fertilised plants resulting. This cross tended to rejuvenate the Münchinger variety, the yield of which had considerably diminished.

Crossing was carried out in 1909, the resulting seed being sown in 1910.



The young plants grew normally, but none of the groups obtained were uniform. The colour of the flowers and tubers varied considerably.

For breeding, 67 plants were chosen; a very variegated mixture of tops and tubers were obtained, but they appeared sound and healthy. This chiefly occurs in crosses between the Switez and Münchinger varieties, which have both given, on crossing, better results than their parent forms.

For the continued selection, 14 plants of the Switez-Münchinger cross were chosen, in consideration of their characters for regularity of development, high yielding capacity, well shaped tubers with yellow flesh.

In the 3rd. generation unequal growth and development was noticed. A few specimens were attacked with leaf curl, and *Phytophthora infestans* was only slightly present on the stems. Both starch content and yield in tubers varied greatly. This diversity is all the more surprising since the tubers had been carefully sorted in the 1st. and 2nd. generations. For this reason, all the poorer grades were eliminated and only 9 plants were used to continue the selection.

The 4th. generation (obtained from the 9 plants) were grown separately according to the family and in parallel with one of the maternal parents, the Switez variety. During this operation, 2 lines (22-6 and 22-7) showed themselves to be undoubtedly the best and most uniform, fulfilling all the writer's requirements. Their yield in tubers is much higher than that of the parent form Switez.

The 5th. generation was quite satisfactory, the yields being 203.1 and 215.3 cwt. respectively per acre. The proportion of small potatoes was 2 per cent.

In the 6th. generation, the lines 22-6 and 22-7 yielded respectively 243.7 and 191.2 cwt. per acre. This difference was solely due to differences in manuring. In addition the lines 22-6 and 22-7 showed very good disease-resisting qualities.

On account of these good results the writer made further crosses, in 1913, the varieties used being most carefully chosen.

The crosses were:

Switez ♀ × Industrie ♂

Industrie ♀ × Switez ♂

Industrie ♀ × Wurstkartoffel ♂

Switez ♀ × Blochinger ♂

Wurstkartoffel ♀ × Switez ♂

Switez ♀ × Wurstkartoffel ♂

The crosses were all successful, as was the cultivation of the plants obtained from the hybrid berries. The plants of the first generation differed much from one another. The 2nd. generation from the crosses made in 1913 gave very satisfactory results. The yield in tubers was higher than the former one. The selection of the 2nd. generation was, therefore, continued. It is probable that the crosses Switez ♀ × Wurstkartoffel ♂ and Industrie ♀ × Wurstkartoffel ♂ will yield varieties that will fully meet with the approval of the agriculturists of Southern Germany.



## CONCLUSIONS.

1) The frequent observation that the growth of plants obtained from non-hybridised potato berries results in no improvement of the variety is fully confirmed by these experiments. The first generations obtained in such a way show abundant growth and give rise to the idea that sexual reproduction has improved the variety, but, even after the 3rd. and 4th. years of cultivation, the plants decline and finally give a much inferior yield to that of the parent forms. This decline of the progeny during the course of other generations has been observed by the author not only in the old varieties of the country, such as Münchinger and Unterländer Wurstkartoffel, but also in the new and very vigorous varieties, such as Switez, Bohun, Alma, etc.

2) On the other hand, selection by crossing gives a better result, especially when the subjects crossed are of healthy, new and vigorously-growing varieties. Certain characters feebly present in the one variety, should be strongly present in the other.

3) As the potato plant seems, in the great majority of cases, to be a heterozygous plant, no uniformity can be seen in the first generation, either in plants obtained by artificial hybridisation or in plants obtained by hybridisation in other ways. There is nearly always a certain concordance of characters among the plants of some determined variety or cross, but there always appear variations, more or less strong according to the type of the variety.

4) In the descendants of seedling plants which should be considered as lines of vegetative reproduction, there occur not only the usual little regular variations, but sometimes large individual variations that are entirely hereditary. Thus, also with potatoes, it is possible to indicate fairly accurately the possibility of a selection based on vegetative reproduction.

629 - Studies on the Hybrids of *Capsicum annuum*: Part II. On some Variegated Races. — IKENO, S., in the *Journal of Genetics*, Vol. 6, No. 3, pp. 210-229, 2 figs., VIII plates, Cambridge, April 1917.

In the botanical garden of Komaba, near Tokyo, in 1913, many individuals of *Capsicum annuum* were noticed which were remarkable for a yellow variegation, not only of the leaves, but also of the branches, various parts of the flower and the fruit. This characteristic, due to the formation of patches lacking in chlorophyll, develops in different degrees of intensity in different individuals, and, in some cases, consists of a few small yellow spots scattered over the leaves. When, on the other hand, the yellow surface is greatly developed, the plant presents a distinctly pathological appearance and grows slowly and with difficulty. The results are given of a study on the progeny of these variegated specimens, obtained both by self-fertilisation and by hybridisation with a normal green plant.

The intensity of the variegation is in direct proportion to that of the parents. If the progeny are divided into intensely variegated plants (*i. var.*) and slightly variegated plants (*s. var.*), it can easily be seen that the

percentage of the second type decreases as the proportion of the variegation of the parent plant increases, and vice versa.

1913	1914	1915	1916
	<i>s. var.</i> 84 (= 25 %)	<i>s. var.</i> 294 (= 92 %) <i>i. var.</i> 25 (= 8 %)	
<i>i. var.</i>	<i>i. var.</i> 254 (= 75 %)	green branches <i>s. var.</i> 95 (= 66 %) <i>i. var.</i> 49 (= 34 %)	
		variegated branches <i>s. var.</i> 80 (= 34 %) <i>i. var.</i> 152 (= 66 %)	<i>s. var.</i> 14 (= 17 %) <i>i. var.</i> 68 (= 83 %)

It is interesting to note the specific manner in which the various parts of the plants tend to transmit their characteristics integrally; thus, fruit produced on the green branches of intensely variegated plants give a percentage of intensely variegated plants much inferior (34 %) to that borne by variegated branches of the same plant (65.5 %).

In no case were completely green plants obtained. By crossing with normal green plants, variegated individuals were obtained in the 1st. generation whose descendants in the 2nd. generation, whether obtained by self-fertilisation or by crossing with green specimens, were variegated. This second generation showed no scission between the green and variegated characteristics in the Mendelian sense of the word; the only deviations noticed were in the variegation, never in the self-coloured green. The characteristics under consideration were, therefore, not Mendelian. If successive generations are constantly crossed with the normal green type the variegation shows a tendency to decrease, but never disappears altogether.

Partial chlorosis in the leaves, branches and fruit of *Capsicum annuum* is not transmitted by the cellular nucleus of the egg, but by the cytoplasm, or more correctly speaking, by the plastids (leucites) which it contains, plastids which, unlike the chloroplasts, do not possess the faculty of producing the chlorophyll-pigment. In the variegated specimens, the egg-cells contain a certain number of plastids of both kinds, that is to say normal and diseased. During the segmentation of the fertilised egg, the plastids also multiply rapidly by fission and enter the cells in varying quantities and proportions, so that, in an adult plant, the distribution of abnormal plastids is far from being uniform, but varies very greatly in the different organs.

This hypothesis explains: 1) the absence of Mendelian phenomena; 2) the behaviour of progeny whose intensity of variegation is proportionate to that of the parents; 3) the attenuation of the variegation as a result of repeated crossing with normal green individuals.

Similar facts have been described for *Mirabilis albomaculata* (CORRENS) *Antirrhinum majus albomaculatum* (BAUR), *Melandrium* (*Lychnis dioica*) *chlorinomaculatum* (SHULL) and *Primula sinensis* (GREGORY). These observations are the first to be published for *Capsicum*, and are interesting in connection with constitutional chlorosis in plants and its inheritance.

630 -- **Reduplication Series in Sweet Peas.** — PUNNET, R. C., in the *Journal of Genetics*, Vol. VI, No. 3, pp. 185-193, III tables. Cambridge, April, 1917.

This paper is a continuation of previous work (1) on the degree of affinity between the various characters in the formation of sexual cells or gametes ("coupling", "Faktorenkuppelung"). The results of experiments carried out in 1914-1915 with *Lathyrus odoratus* (Sweet Pea) are given. The data deal only with the **BEL** series, where **B** = the blue colour of the flower as opposed to the red, **b**; **E** = an erect standard as opposed to a hooded standard **e**; **L** = long pollen as opposed to round pollen 1.

1) *The relation between E and L in homozygous plants with reference to the colour (BB or bb).* The mating **EL** × **el**, which does not, of course, change the colour, gives, in the 1st. generation, individuals with the formula **Ee Ll**, capable of producing 4 kinds of gametes: **EL** — **E1** — **eL** — **el**. In the **F<sub>2</sub>**, 1118 plants were obtained and examined. They were divided up as follows:

	<b>EL</b> Erect standard Long pollen	<b>E1</b> Erect standard Round pollen	<b>eL</b> Hooded standard Long pollen	<b>el</b> Hooded standard Round pollen
Number of plants found. . . . .	765	62	71	220
Expectation on 7:1:1:7 basis. . .	<b>773</b>	<b>65.5</b>	<b>65.5</b>	<b>214</b>

If, as is usual, 4 sorts of gametes are formed in equal proportions (1 **EL**: 1 **E1**: 1 **eL**: 1 **el**), and if they have equal opportunities of recombining, **F<sub>2</sub>** should give very different values from those actually obtained:

<b>EL</b>	<b>E1</b>	<b>eL</b>	<b>el</b>
630 (9/16)	280 (3/16)	280 (3/16)	70 (1/16)

This fact is explained as follows: — **E** and **L** on one hand, and **e** and **l**, on the other, have a greater coupling intensity than that which exists between **e** and **L** on the one hand, and **l** and **E** on the other, the ratio being 7 **EL**: 1 **E1**: 1 **eL**: 7 **el**. In the division of the 1118 plants of **F<sub>2</sub>** this ratio would give figures very near to those actually obtained. The actual figures are given in brackets: 773 (765) — 65.5 (62) — 65.5 (71) — 214 (220).

2) *Relation between the colour of the flower and the shape of the pollen.* — In 1912 a red hooded plant with round pollen was crossed with a Lord Nelson, a full blue with long pollen and hooded standard. **F<sub>1</sub>** was composed of purple hooded plants with long pollen. The 632 plants of **F<sub>2</sub>** were divided up as follows:

<b>BL</b>	<b>Bl</b>	<b>bL</b>	<b>bl</b>
419	29	57	127

(1) Cf. *Journal of Genetics*, Vol. III, 1913, p. 77.



As in the preceding case, these proportions may be explained by assuming the number of gametes **BL** and **bl** to be 7 times as large as that of **Bl** and **bL**, so as to give the ratio 7 : 1 : 1 : 7. Values closely related to the ones obtained could then be calculated: — 437 (419) — 37 (29) — 37 (57) — 121 (127).

3) *Relation between the colour of the corolla and the shape of the standard.*  
— The mating **BEL** × **bel** gave, in  $F_2$ , 1 803 plants divided as follows:

<b>BE</b>	<b>Be</b>	<b>bE</b>	<b>be</b>
1296	12	10	485

This case, therefore, differs from the preceding ones; instead of the ratio 7 : 1 : 1 : 7, we have the ratio 63 : 1 : 1 : 63. Values approaching the actual ones may thus be obtained: — 1 337 (1296) — 14 (12) — 14 (10) — 438 (485).

These investigations are interesting and important not only for biological science, but also for its practical application. The results given above for the 2nd. generation of hybrids may help the breeder to greater accuracy in the combination and re-combination of the most valuable characters in the different varieties cultivated.

631 — *Studies in the Inheritance of Doubleness in Flowers, II. Meconopsis, Althaea and Dianthus.* — SAUNDERS, EDITH R., in the *Journal of Genetics*, Vol. VI, No. 3, pp. 165-184. Cambridge, April, 1917.

As a continuation of her work on the genus *Petunia* (1) begun in 1911, the author has made a careful experimental study of the nature and capacity of transmission of the double character in the genera *Meconopsis*, *Althaea* and *Dianthus*. Results were obtained which are of interest not only for science, but also for practical selection in horticulture.

*Meconopsis cambrica* (Welsh Poppy). — In the double flowered types this characteristic, even in one and the same individual, shows infinite gradations, from the almost normal type to sterile flowers where all, or nearly all, of the stamens are present in the form of petals. The cross between single-flowered and double-flowered types gives in the  $F_1$  (1st. hybrid generation) individuals with double flowers, and in the  $F_2$  (2nd. hybrid generation) a ratio of 3 doubles to 1 single; the double character is, therefore, dominant.

*Althaea rosea* (Hollyhock) and *A. ficifolia* (Antwerp Hollyhock). — In the  $F_1$  generation the individuals showed intermediate characteristics. In the  $F_2$  generation, however, the ratio was 1 single; 2 crossbreds: 1 double; there is, therefore, no specific dominance of either characteristic. The hybrids in  $F_1$  with the formula  $DS$  ( $D$  = double;  $S$  = single), may give, in  $F_2$ , 4 different groupings:  $DD$  —  $DS$  —  $SD$  —  $SS$ . If all these groups have equal chances of developing, the progeny produced will be in the following ratio: — 1 double: 2 crossbreds: 1 single

(1) Cf. SAUNDERS, E. R., *Studies in the Inheritance of Doubleness in Flowers; I. Petunia*, in the *Journal of Genetics*, Vol. I, p. 57. Cambridge, 1910.

*Dianthus Caryophyllus* (Carnation): — Behaviour similar to that of *Meconopsis*.

*Dianthus barbatus* (Sweet William). — In the double variety, the stamens take the form of petals. If a single is crossed with a double, the individuals of  $F_1$  will be singles, and the  $F_2$  generation will include 3 singles to 1 double. Unlike *Meconopsis cambrica* and *Dianthus Caryophyllus*, the single character is in this case dominant to the double.

632 — **Dry Farmed and Irrigated Wheat.** — JONES, J. S. and COLVER, C. W., in *University of Idaho Agricultural Experiment Station* (Departments of Chemistry and Home Economics), *Bulletin* No. 88. 20 pp., 3 tables. Moscow (Idaho), 1916.

This report on dry-farmed and irrigated wheat covers the completed portion of a general investigation which was commenced in 1907 and which has for its ultimate object the study of the factors which determine the protein content of normally matured wheat.

Gluten is the most important constituent of wheat flour because it makes possible the baking of light bread. The gluten content of flour depends upon the protein content of the wheat from which it was ground and, although flours may vary rather widely in the percentage content of gluten without varying to the same extent in baking value, a reasonable percentage of gluten is absolutely necessary to insure satisfactory results under normal conditions of baking.

There is a widespread feeling among investigators, grain buyers and millers, that the maintenance of quality in wheat depends primarily upon the maintenance of a high protein content and that the improvement of northwestern grown wheat is intimately connected in some way with a substantial increase of that constituent in the commonly grown varieties. At any rate, those wheats which establish the standards of excellence in milling centres are relatively high in protein and produce flours of relatively high gluten content. Finally, experience teaches that no matter what other objects the wheat breeder may attain, they are for practical purposes almost valueless if, in their attainment, protein content is materially sacrificed.

In the Pacific North West, wheat is cultivated under very variable conditions. Whether or not quality could be correlated in any marked degree with such differences appears to be ascertainable only by the systematic collection of samples through a term of years, and the performance of the necessary analytical work and baking tests. The first report was made in 1911. This one is supplementary to a certain extent, but deals specifically with wheat grown in south Idaho under two radically different systems of farming — dry-farming and irrigation. The samples reported upon were grown and secured for analytical, milling and baking tests in 1912, 1913 and 1914.

Examination of the data secured suggests that possibly some varieties of wheat respond more quickly to changes of environment than do others. This seems to be particularly true of Turkey Red and Marquis. Nevertheless, the protein of the average dry-farmed sample was only one per cent.



TABLE I. — *Mill Products.*

Variety and how grown		Bran	Shorts	Flour	Gain (+) or loss (—) in milling percent.
Bluestem	dry-farming . . . . .	12.87%	18.45%	67.99%	— 0.69
Bluestem	irrigated . . . . .	12.45	18.51	68.26	— 0.78
Bluestem (Haynes)	irrigated . . . . .	10.42	17.80	75.17	+ 3.39
California Club	irrigated . . . . .	24.52	11.30	62.50	+ 1.68
Canadian Hybrid	dry-farming . . . . .	10.67	17.00	74.15	+ 1.82
College Hybrid	irrigated . . . . .	15.87	17.46	61.90	— 4.77
Colorado No 50	dry-farming . . . . .	14.62	17.58	70.98	+ 3.18
Dago	irrigated . . . . .	10.64	16.60	75.74	+ 2.98
Defiance	irrigated . . . . .	12.75	16.88	71.81	+ 1.44
Dicklow	irrigated . . . . .	14.23	16.19	69.62	+ 0.04
Fife	dry-farming . . . . .	14.72	15.35	70.98	— 1.05
Forty Fold	dry-farming . . . . .	12.77	19.67	68.60	+ 1.08
Fultz	dry-farming . . . . .	16.67	15.00	66.67	— 1.66
Gold Coin	dry-farming . . . . .	13.54	17.15	70.83	+ 1.52
Galgalos	irrigated . . . . .	14.41	14.40	71.19	—
Indian	irrigated . . . . .	20.25	15.19	64.13	— 0.43
Jim Holley	irrigated . . . . .	15.12	16.20	70.18	+ 1.50
Koefert	dry-farming . . . . .	15.38	13.68	70.94	—
Little Club	dry-farming . . . . .	10.00	16.00	72.00	— 2.00
Little Club	irrigated . . . . .	12.70	12.43	74.10	— 0.77
Loft House	dry-farming . . . . .	8.03	22.63	64.60	— 4.74
Mackay	dry-farming . . . . .	9.23	19.23	70.00	— 1.54
Mackay	irrigated . . . . .	11.94	19.42	68.64	—
Marquis	dry-farming . . . . .	13.34	20.00	68.32	+ 1.66
Marquis	irrigated . . . . .	11.65	15.64	77.15	+ 4.44
Minnesota No 163	irrigated . . . . .	16.53	10.59	74.16	+ 1.28
Odesa	dry-farming . . . . .	14.17	17.50	68.33	—
Red Chaff	dry-farming . . . . .	15.56	14.82	64.44	— 5.18
Sonora	dry-farming . . . . .	14.68	20.67	63.26	— 1.39
Sonora	irrigated . . . . .	14.17	19.17	65.00	— 1.66
Tause	dry-farming . . . . .	14.53	15.38	65.39	— 4.70
Three I.	dry-farming . . . . .	11.53	17.79	72.32	+ 1.64
Turkey Red	dry-farming . . . . .	11.78	18.06	73.33	+ 3.17
Turkey Red	irrigated . . . . .	10.26	19.58	74.06	+ 3.90
Winter Fife	dry-farming . . . . .	9.53	17.13	43.71	+ 0.37
<i>Averages of irrigated varieties*</i>		<b>12.62%</b>	<b>17.93%</b>	<b>70.62%</b>	<b>+ 1.17</b>
<i>Average of dry-farmed varieties**</i>		<b>12.64%</b>	<b>17.04%</b>	<b>71.34%</b>	<b>+ 1.12</b>

\* Total number of samples analysed: 79.

\*\* Total number of samples analysed: 60.

greater and the protein of its flour only seven-tenths per cent. greater than that of the average irrigated sample — differences too small to be strongly reflected in the gluten percentage either wet or dry. There were no significant differences between the average dry-farmed and irrigated sample in weight per bushel, in weight per 1000 grains, or in percentage of moisture, ash and fatty matter.

Results of baking tests in many ways do not support the commonly



TABLE II. — *Composition of the wheat and flour.*

Variety and How Grown				Wheat			Flour					
Weight per bushel, lbs.	Weight of 1 000 grains.	Moist- ure	Ash	Ether Extract	Crude protein (N X 6.25)	Moist- ure	Ash	Ether Extract	Crude protein (N X 6.25)	Gluten wet	Gluten dry	Gladiol
58.6	37.65 gr.	10.12 %	1.81 %	2.06 %	11.75 %	12.83 %	0.47 %	1.11 %	9.15 %	30.45 %	10.47 %	4.83 %
58.9	38.66	10.48	1.80	2.04	11.06	13.32	0.49	1.17	8.77	28.10	9.41	4.35
57.0	31.66	10.48	1.81	2.54	11.73	12.80	0.58	1.24	9.53	29.34	10.09	5.59
57.0	32.71	10.21	1.48	2.20	9.56	13.60	0.46	1.08	8.08	29.07	10.11	4.60
57.3	37.34	10.25	1.79	2.03	11.38	12.58	0.50	1.20	9.02	26.84	8.83	4.51
55.5	23.58	9.61	2.00	2.68	11.12	12.26	0.44	1.01	9.18	26.50	9.33	5.70
59.8	34.32	11.29	1.83	2.15	12.51	13.26	0.48	1.24	8.56	30.36	10.09	4.51
60.5	38.90	10.66	1.46	2.68	11.56	13.70	0.49	1.48	8.58	28.02	8.50	5.25
59.3	36.30	10.79	1.73	2.11	11.79	13.82	0.53	1.23	9.24	30.85	9.97	5.35
57.9	35.40	10.50	1.70	2.20	10.56	13.54	0.48	1.18	7.88	24.85	8.50	4.44
60.8	34.40	10.53	1.78	2.24	11.12	13.07	0.43	1.12	8.78	26.27	9.41	4.10
56.8	38.76	10.07	1.76	2.09	12.75	13.13	0.47	1.12	9.82	30.04	9.90	5.02
56.0	32.88	11.15	1.73	2.18	13.42	13.18	0.46	1.06	11.34	35.50	12.49	4.90
59.0	37.66	10.89	1.70	2.02	12.54	13.24	0.47	1.09	9.73	32.35	10.76	5.23
61.0	43.58	10.69	1.76	1.86	11.34	13.94	0.44	1.34	8.65	25.17	8.07	5.70
60.5	33.66	10.02	1.81	2.32	10.16	13.31	0.44	1.31	7.66	25.39	8.22	4.33
57.3	34.89	9.74	1.80	2.31	9.15	13.69	0.44	1.20	6.87	19.17	6.86	3.82
60.0	45.50	10.63	1.78	2.09	12.41	13.79	0.41	1.06	9.62	31.87	11.11	4.79
59.5	33.70	10.47	1.83	2.14	10.79	12.63	0.50	1.20	8.56	31.96	10.78	4.91
59.8	30.26	20.31	1.82	2.22	10.83	12.76	0.48	1.18	8.85	26.51	8.88	4.61
59.0	51.90	9.63	1.85	1.82	11.05	13.61	0.42	1.08	8.00	32.13	10.71	4.58
59.0	32.46	9.37	1.85	2.04	14.38	11.86	0.51	1.07	11.42	37.70	12.15	4.56
60.0	32.20	8.88	2.09	1.95	13.95	11.86	0.51	0.94	10.82	32.95	12.26	4.56
57.0	26.62	11.76	1.85	2.52	14.78	13.45	0.58	1.34	11.94	35.80	12.95	5.70
60.8	34.11	10.10	1.75	2.40	12.17	12.62	0.60	1.18	10.11	31.63	10.93	4.93
59.0	35.30	11.17	1.81	2.57	12.41	14.37	0.68	1.14	9.38	29.53	10.07	5.48
59.5	33.84	9.75	1.72	2.20	11.60	14.07	0.39	1.03	9.28	28.03	10.62	5.70
58.5	24.58	9.37	1.96	2.19	14.93	11.92	0.33	0.99	11.06	33.45	11.57	5.24
63.0	32.06	10.67	1.72	2.68	11.67	12.77	0.51	1.37	9.39	28.99	10.14	4.67
61.0	25.56	9.81	1.79	2.80	11.50	11.68	0.53	1.37	9.38	28.05	10.17	4.16
52.0	35.66	10.30	1.76	2.68	9.95	13.49	0.45	1.22	7.48	24.62	7.47	5.93
56.8	32.54	9.48	1.69	2.30	10.27	12.09	0.47	1.15	8.40	25.40	8.59	5.03
Three I	36.24	9.48	1.67	2.30	10.27	12.09	0.47	1.15	8.40	25.40	8.59	5.03
Three I	36.24	9.48	1.67	2.30	10.27	12.09	0.47	1.15	8.40	25.40	8.59	5.03
Three I	36.24	9.48	1.67	2.30	10.27	12.09	0.47	1.15	8.40	25.40	8.59	5.03
Three I	36.24	9.48	1.67	2.30	10.27	12.09	0.47	1.15	8.40	25.40	8.59	5.03
Three I	36.24	9.48	1.67	2.30	10.27	12.09	0.47	1.15	8.40	25.40	8.59	5.03
Three I	36.24	9.48	1.67	2.30	10.27	12.09	0.47	1.15	8.40	25.40	8.59	5.03
Three I	36.24	9.48	1.67	2.30	10.27	12.09	0.47	1.15	8.40	25.40	8.59	5.03
Three I	36.24	9.48	1.67	2.30	10.27	12.09	0.47	1.15	8.40	25.40	8.59	5.03
Three I	36.24	9.48	1.67	2.30	10.27	12.09	0.47	1.15	8.40	25.40	8.59	5.03
Three I	36.24	9.48	1.67	2.30	10.27	12.09	0.47	1.15	8.40	25.40	8.59	5.03
Three I	36.24	9.48	1.67	2.30	10.27	12.09	0.47	1.15	8.40	25.40	8.59	5.03
Three I	36.24	9.48	1.67	2.30	10.27	12.09	0.47	1.15	8.40	25.40	8.59	5.03
Three I	36.24	9.48	1.67	2.30	10.27	12.09	0.47	1.15	8.40	25.40	8.59	5.03
Three I	36.24	9.48	1.67	2.30	10.27	12.09	0.47	1.15	8.40	25.40	8.59	5.03
Three I	36.24	9.48	1.67	2.30	10.27	12.09	0.47	1.15	8.40	25.40	8.59	5.03
Three I	36.24	9.48	1.67	2.30	10.27	12.09	0.47	1.15	8.40	25.40	8.59	5.03
Three I	36.24	9.48	1.67	2.30	10.27	12.09	0.47	1.15	8.40	25.40	8.59	5.03
Three I	36.24	9.48	1.67	2.30	10.27	12.09	0.47	1.15	8.40	25.40	8.59	5.03
Three I	36.24	9.48	1.67	2.30	10.27	12.09	0.47	1.15	8.40	25.40	8.59	5.03
Three I	36.24	9.48	1.67	2.30	10.27	12.09	0.47	1.15	8.40	25.40	8.59	5.03
Three I	36.24	9.48	1.67	2.30	10.27	12.09	0.47	1.15	8.40	25.40	8.59	5.03
Three I	36.24	9.48	1.67	2.30	10.27	12.09	0.47	1.15	8.40	25.40	8.59	5.03
Three I	36.24	9.48	1.67	2.30	10.27	12.09	0.47	1.15	8.40	25.40	8.59	5.03
Three I	36.24	9.48	1.67	2.30	10.27	12.09	0.47	1.15	8.40	25.40	8.59	5.03
Three I	36.24	9.48	1.67	2.30	10.27	12.09	0.47	1.15	8.40	25.40	8.59	5.03
Three I	36.24	9.48	1.67	2.30	10.27	12.09	0.47	1.15	8.40	25.40	8.59	5.03
Three I	36.24	9.48	1.67	2.30	10.27	12.09	0.47	1.15	8.40	25.40	8.59	5.03
Three I	36.24	9.48	1.67	2.30	10.27	12.09	0.47	1.15	8.40	25.40	8.59	5.03
Three I	36.24	9.48	1.67	2.30	10.27	12.09	0.47	1.15	8.40	25.40	8.59	5.03
Three I	36.24	9.48	1.67	2.30	10.27	12.09	0.47	1.15	8.40	25.40	8.59	5.03
Three I	36.24	9.48	1.67	2.30	10.27	12.09	0.47	1.15	8.40	25.40	8.59	5.03
Three I	36.24	9.48	1.67	2.30	10.27	12.09	0.47	1.15	8.40	25.40	8.59	5.03
Three I												

held views regarding the relative values for bread making purposes of dry farmed and irrigated wheat. They suggest the possibility of making greater progress toward the raising of flour standards in this state by a systematic insistence on the part of housewives for brands of flour that have been ground from the better varieties of wheat rather than by discrimination in favour of either the dry-farmed or the irrigated product.

633 - Study on the Digestibility of the Grain Sorghums. — LANGWORTHY, C. F. and HOLMES, A. D. in *United States Department of Agriculture Bulletin* No. 470, pp. 33. Washington December 22, 1916.

As a result of research into the crops best suited to the semi-arid regions of the Western United States, non-saccharine grain sorghums have been successfully introduced from South Africa. The best known varieties of this cereal are feterita, kafir, dwarf milo and kaoliang.

Experiments are now being made on the best method of utilising these grains. Much has already been published on their use as a feeding-stuff for cattle, but little work has been done on their value as food for human consumption (on this subject see: *U. S. Department of Agriculture, Farmers' Bulletin* 559 (1913), pp. 6-7; *Northwestern Miller*, 1912, No. 2, pp. 79-80; *Oklahoma State Circular* 27, (1914), 8 pp.; *Texas Department of Agriculture Bulletin* 41 (1915), p. 18; *Operating Miller* 20, 1915 No. 1, pp. 42-44; *South Dakota Agricultural Experiment Station Bulletin* 158 (1915) pp. 170-174). The results of these experiments on the milling of these cereals and their value in human nutrition may be summarised as follows:

In the first set of experiments the rations included milk, sugar, fruit (oranges) and "hard" sorghum bread. This bread was prepared by mixing meal and water (in equal volumes), salt and lard boiled for half an hour; baking powder was then added and the bread baked in a very thin layer. The bread thus obtained was very dry, hard with a thick crust and practically no crumb, and was rather insipid. It was found that 58 % of the protein of the cereal had been digested. It is possible that owing to the high proportion of milk protein in the ration, the figure given for the cereal protein alone may exceed its actual value.

In the later, more numerous experiments the grain was eaten in the form of a softer bread or of mushes. This "soft" bread was made as follows: 15 cups of meal, 3  $\frac{3}{4}$  teaspoons of soda, 1  $\frac{7}{8}$  cups of molasses, 3  $\frac{3}{4}$  teaspoons of salt, 5 teaspoons of ginger, 1 small cup of lard (melted), 1  $\frac{7}{8}$  quarts of hot water. The mixture was kneaded and baked for about 1  $\frac{1}{2}$  hours.

The mush was prepared by adding to the meal the requisite amount of salt and a little more boiling water than could be absorbed. The whole was then boiled for 3 to 4 hours in a double boiler at a temperature just below boiling point. The bread and mush thus prepared were very palatable. The basal ration consisted of apple sauce, potatoes, butter and sugar.

On the average 51 % of the protein of the soft dwarf kafir bread



was digested, and 48 % of the protein of the dwarf kafir mush. The feterita varieties gave the same percentages. The proportions for the dwarf milo variety were 40 % and 34 % respectively ; and for kaoliang 20 % and 4 %

*Fat* was present in these grains in very small and relatively unimportant quantities and, therefore, no attempt was made to estimate its digestibility.

In all cases the *carbohydrates* of the rations and the sorghum were completely utilised. Considering the grain alone, apart from the complete ration, the average amount used was : 98 % for the "hard" dwarf kafir bread, 96 % for the "soft" dwarf kafir bread ; 96 % for the dwarf kafir mush. For feterita the average values were 97 % for the bread and 99 % for the mush ; for dwarf milo, 96 % for the bread and 98 % for the mush ; for kaoliang 96 % for both bread and mush.

For purposes of comparison, digestibility experiments were made with corn and wheat bread prepared by the same method as the "soft" sorghum bread and consumed with the same basal ration. The corn and wheat proteins were found to be digested rather less thoroughly than usual. This is doubtless to be attributed to the excessive simplicity of the ration. The average digestibility of the corn bread protein was 60 % and that of the wheat bread protein 77 % ; that of the carbohydrates was 96 % and 95 % respectively.

The experiments with all the grains were carried out under conditions as nearly uniform as possible so as to obtain directly comparable results. It may be concluded, therefore, that sorghum protein is less digestible than that of corn or wheat.

From the results of these, and other experiments, sorghum may be said to be of real value in human nutrition. At the same time, special methods of cooking are required to make of it a really palatable and nourishing food ; it is of great importance that the meal, whose particles are particularly hard and flinty, should absorb sufficient water to be thoroughly softened.

Sorghum protein is not so completely assimilated as that of wheat or corn, but, with the exception of kaoliang, this grain forms a fairly good source of this nutrient. They also supply a good quantity of carbohydrates in a form which is completely assimilable.

634 - **Researches on the Mechanism of Cicatrisation of Wounds caused by Tapping in Rubber-producing Plants.** — HEM, F., in *Bulletin de l'Office Colonial*, 10th. year. Nos. 110-111, pp. 95-102 + 3 plates. Melun, February-March, 1917.

RUBBER PLANTS

In practice, preference should be given to the method of tapping which does the least damage to the plants, both as regards length of life and subsequent yield of latex when tapped anew.

The writer gives a detailed summary of two sets of researches conducted in collaboration with M. J. MAHEU, on the microscopic anatomy of the African rubber plants: *Clitandra Arnoldiana* and *Funtumia elastica*. He then concludes as follows: It is hardly necessary to emphasise the grave drawbacks resulting from incisions which result in large wounds with gaping edges remaining open over long periods.



The processes of regeneration of the lactiferous ducts and the re-establishment of the circulation of the latex demonstrate that, in practice, the best method of tapping is to make use of a number of incisions of small size, thus rendering easier the healing of the lactiferous vessels. Large incisions of circular shape should be abandoned, as they hinder the re-establishment of the circulation of latex by the production of collateral circulatory systems.

STIMULANT,  
AROMATIC,  
NARCOTIC,  
AND  
MEDICINAL  
CROPS

- 635 — **Experiments on the Manuring of Cacao in Java, from 1912 to 1914.** — PEELEN, J. R. C. and DE JONG, A. W. K., in *Mededeelingen van het Proefstation Midden-Java*, No. 24, Batavia, 1917.

In 1911, in the Djati-Roengge plantations, situated in the centre of the island, a set of cacaos was selected for a comparative experiment on the effect of farmyard manure used alone and in conjunction with superphosphate. The trees were treated as usual and the yield noted of dry beans.

The conclusion is that farmyard manure alone only gives a very slight increase, whereas in conjunction with superphosphate the results have been excellent. Compared with the check lots the surplus yield was as follows: 40 % in 1912 — 50 % in 1913 — 63 % in 1914 against 3 to 11 % with farmyard manure alone.

The experiment is to be continued using superphosphate alone.

HORTICULTURE

- 636 — **Cultivation of Beans in Germany: Trials to Determine the Best Number of Plants per Pole.** — UNSELT, in *Moeller's Deutsche Gaertner Zeitung*, Part. 7, pp. 51-52. Erfurt, 1917.

In Germany, the usual number of beans per pole is 5-8, sometimes even 11-13, and many people think that by increasing the number of plants they obtain bigger yields. The writer does not agree with this, as he considers that too many plants give too thick a foliage and many of the leaves live at the expense of others. The consequence is that the yield is reduced and there is a useless waste of seed. The writer himself keeps 3-4 plants per pole and claims to get bigger crops this way than by planting a greater number. In order to prove this he arranged a trial, in 1916 using 5 rows of poles, with the following number of seeds to each pole.

1st. row . . . . .	1 plant per pole
2nd. row . . . . .	2 plants » »
3rd. row . . . . .	3 » » »
4th. row . . . . .	4 » » »
5th. row . . . . .	5 » » »

The beans (6 pickings) gave the following yields:

	Yield per pole
1st. row . . . . .	1.966 kg.
2nd. row . . . . .	2.233
3rd. row . . . . .	2.233
4th. row . . . . .	1.333
5th. row . . . . .	1.266

The poles with 2 and 3 plants gave equal and maximum results. On the other hand, by planting 8-12 seeds per pole the result obtained would, at the very most, be equal to that of row 5, that is to say the yield would be considerably smaller and the amount of seed used considerably greater.

637 - **Fruit varieties for Maine.** — BROWN, BLISS S., in *University of Maine, Agricultural Extension Service, Extension Bulletin No. 111*, pp. 19. Orono, Maine, January 1917.

FRUIT  
GROWING

Fruit cultivation in Maine covers about 91 000 acres; if the land known as "Blueberry Barrens" (sterile soil covered with a wild growth of *Vaccinium corymbosum*) be added to this, there is a total of 241,000 acres. The value of the fruit industry is about 2  $\frac{1}{2}$  million dollars per annum. Apples supply 98 % of the fruits and about 90 % of the cash value of all the fruits in the State. The kinds of fruit cultivated are few in number, A list of the most common varieties of each kind and those usually considered the best, is given below (1).

APPLES: — *Spring varieties*: Blue Permain, Northern Spy\*, Spitzenburg\*\*, Roxbury Russet, Stark\*, Ben Davis\*\*.

*Summer varieties*: — Red Astrachan\*\*, Yellow Transparent, \*\* Sweet Bough, Chenango (Strawberry), Williams.

*Autumn varieties*: — St. Laurence, Alexander, Wolf River, Duchess (Oldenburg)\*\*, Graevenstein\*.

*Early Winter Varieties*: — Snow (Fameuse)\*\*, MacIntosh Red\*, Nod Head\*, Potter, King\*, Wealthy\*\*, Fall Pippin, Rolfe\*\*, Milden\*\*, Grimes Golden, Pound Sweet.

*Late Winter Varieties*: — Hubbardston, R. I. Greening\*, Bellflower\*\*, Rome Beauty\*\*, Delicious\*, Winter Banana\*\*, Winter Pippin, Baldwin\*, Newtown Pippin, Tolman Sweet\*\*;

PEARS: — Bartlett, Sheldon, Seckle, Beurre d'Anjou, Beurre Bosc, Clapp's Favorite, Kieffer, Vermont Beauty.

PLUMS: — Abundance, Burbank, Red June, Wickson, Satsuma, Lombard, German Prune, Damsen, Arctic, Quackenboss.

CHERRIES: — *Sour Varieties*: — Early Richmond, Montmorency, English Morello, May Duke.

*Sweet varieties*: — Black Tartarian, Lambert, Bing. Cherries do very well.

PEACHES (Cultivated only in a few districts along the coast, and on a small scale, climatic conditions do not allow of a more general distribution): — *White varieties*: — Wadell, Queensboro, Belle of Georgia, Ray, Carmen.

*Yellow Varieties*: — Fitzgerald, Captain Ede, Early Elberta.

QUINCES (The same applies to these as to peaches). — Orange, Borgeaut, Champion.

GRAPES (Grown for home consumption only): — Concord, Niagara, Worden, Moors Early, Delaware, Catawba.

STRAWBERRIES (These give the largest yield of the small fruits); — *Bisexual Varieties* (good pollinators): — Glen Mary, First Quality, Brandywine, Senator Dunlap, Uncle Jim, Abington, Marshall, Ridgeway, Wm. Belt, Barrymore, Gibson, Helen Davis, Chesapeake, Pokomo, Superb, Progressive, (the last 2 are everbearing varieties).

*Pistilate varieties* (contain little or no pollen): — Sample, Bubach, Wooster.

RASPBERRIES: — *Red Varieties*: — St. Regis, Cuthbert, Columbian, Herbert, Marlboro.

(1) \* denotes the varieties most suited to commercial production; \*\* denotes varieties frequently found in commercial orchards and to be recommended when the environmental conditions are favourable.



*Black Caps* : — Cumberland, Gregg, Kansas.

*Purple Canes* (hybrids between red and black) : Golden Queen.

GOOSEBERRIES : — *Red Varieties* : — Industry, Red Jacket, Houghton.

*Yellow Varieties* : Dowing, Keepsake, Champion.

CURRENTS : — *Red Varieties* : — Cherry, Fay Prolific, Perfection, Red Cross.

*White Varieties* : — White Grape, White Imperial.

*Black Variety* : — Champion.

BLACKBERRIES : — Agawam, Eldorado, Taylor, Snyder, Ward.

- 638 - **Effect of Fertilizers on the Composition and Quality of Oranges.** — YOUNG, H. D.  
(Agricultural Experiment Station of the University of California). *Journal of Agricultural Research*, Vol. VIII, No. 4, pp. 127-138. Washington, D. C., January 22, 1917.

Of the great amount of work which has been done with fertilizers, only a relatively small proportion deals with their effects on the quality of the crop. This is especially true of fruits, partly because of the length of time required, and partly because of the conflicting factors which enter into a long-time experiment. The material presented in this paper has to do with oranges (*Citrus aurantium*). The quality of this crop may offer an easier subject for study than most fruits, as the factors affecting it, such as the percentages of sugar and acid, the texture of the fruit as a whole (its specific gravity), and the proportions of juice and rind, can be accurately measured.

The University of California Citrus Experiment Station has maintained a continuous fertilizer experiment since 1907; the experimental area is composed of 20 plots with six trees each of Washington Navel oranges, Valencia oranges, Eureka lemons and Lisbon lemon in each plot; up to the end of 1914 the total amount of fertilisers applied to each tree had been approximately 6 lbs. of nitrogen and potash each, and 12 lbs. of phosphoric acid. A study of the quality and composition of the oranges was first taken up with the crop of 1914; a sample of 10 fruits was taken from each tree and a composite of these fruits taken for analysis, and the sample from one tree of each of the 20 plots was picked and analyzed on the same day.

The following is a summary of the main results arrived at: Nitrogen is the only fertilizer which in this experiment seemed to exercise a specific effect on the composition of oranges; applications of nitrogen to the soil resulted in a slightly lower amount of sugar, a somewhat coarser fruit and a little less juice in the orange; the effect of nitrogen was the same, whether applied alone, in combination with either potash or phosphoric acid, or both. The effect of nitrogen was greater in 1915 than in 1914; as the crop was picked about two months later in 1915 it would indicate that some effect other than delayed maturity was caused by the nitrogen. Comparison with fruit from similar trees grown outside the fertilizer plots shows a fair agreement of composition and quality. The analyses show a higher percentage of nitrogen in the fruit from all plots receiving it, while no such effect was obtained with either phosphoric acid or potash.

Seven references to literature are cited.



639 - Experimental Work in Italy on the Plum (*Prunus domestica* L. var.  *$\alpha$ -aeconomica*) and on the Composition of the Oil extracted from the Kernels.

— FERUGLIO, D. and BERNARDIS, G. B., in *Bollettino dell'Associazione Agraria Friulana*, 61st. Year, Series VII, Vol. 31, pp. 56-75. Udine, December 31, 1916.

In the hilly region around Friuli, and in the neighbourhood of Gorizia, the cultivation of the plum (*Prunus domestica* L. var.  *$\alpha$ -aeconomica* Borck) is of considerable importance. In the "Collio" region alone, at least 70,000 quintals (1 quintal = nearly 2 cwt.) of plums are dried annually, the quantity of dried fruit obtained being about 1 quintal per 5 quintals of fresh plums. The industry in dried plums, with skin and stone removed, which is a very paying one and gives work to a large number of farmers, is particularly developed in the Gorizia region. The sorts commonly cultivated in this zone have been used by the writers for their researches, which may be summarised as follows:

- 1) Average production per tree
- 2) Relations between different portions of the fruit
- 3) Composition of the fruit
- 4) Composition of the kernels
- 5) Composition of the stones devoid of their kernels
- 6) Composition of the leaves and branches produced during the year, and chief constituents of the ash
- 7) Preparation of oil from the kernels
- 8) Physical characters and constants
- 9) Chemical characters and constants
- 10) Qualitative researches upon the fatty acids.

The average dimensions of fruit and kernel are as follows:

	Fruit	Stone
Length . . . . .	3.81 cm	2.31 cm
Width . . . . .	2.75	1.20
Ratio length: breadth . . . . .	1.38	1.92

*Average production per tree.* — Calculating on a productive period of 30 years, the average annual yield per tree is about 20 kg.

An average tree furnishes 4 kg. of fresh leaves, gathered towards the end of September.

The weight of young branches produced during the year and gathered at the same time as the leaves, reaches 3 kg. per plant.

*Relation between the different parts of the fruit.* — The average weight of ripe fruit, immediately after gathering, calculated on numerous lots, is 16.81 kg. per 1000 plums. The minimum figures were observed in 1912 and the maximum in 1913.

For 1000 fruits, the average weight of the stones is 0.810 kg. and that of their kernels 0.216 kg.

These figures give the following proportions:

Skin, pulp and juice . . . . .	95.18 %
Stone without kernel . . . . .	3.53
Kernel with skin . . . . .	1.29

100.00

*Composition of the fruit.* — Analysis of the fruits at the time of picking has given the following minimum and maximum figures:

	In 100 parts of plums free of stone (skin, pulps and juice)
Water . . . . .	83.00 - 84.00 %
Ash . . . . .	0.34 - 0.45
Total Nitrogen . . . . .	0.08 - 0.091
Crude protein ( $N \times 6.25$ ) . . . . .	0.50 - 0.57
Crude fat (ether extract) . . . . .	0.11 - 0.13
Reducing sugars (as invert sugar) . . . . .	4.08 - 4.67
Non-reducing sugars (as saccharose) . . . . .	5.41 - 6.20
Fibre . . . . .	0.36 - 0.46
Pentosans . . . . .	0.61 - 0.64
Acidity of juice (as cc. of normal KOH) . . . . .	5.80 - 6.90 cc.

*Composition of the kernels.* — 100 gr. of dried kernels at 100° C. yielded from 24.81 to 26.81 gr. of crude protein and from 42.61 to 45.69 gr. of crude fat (1). Immediately after picking the kernels contain 20 % of water.

The results of the above analyses, in conjunction with the composition of the leaves and branches produced during the year, have enabled the writers to calculate the annual quantities of nutritive substances removed from the soil; they are given in the following table:

	Quantity of nutritive elements removed per hectare of soil (equivalent to 300 trees) in kg.					
	Nitrogen	Calcium oxide	Magne- sium oxide	Potas- sium oxide	Phos- phoric acid	Sul- phuric acid
Plums (skin, flesh and juice). .	4.86 kg	2.06 kg	0.90 kg	12.12 kg	2.94 kg	1.92 kg
Stones . . . . .	0.24	0.75	0.04	0.16	0.01	0.04
Kernels . . . . .	2.58	0.31	0.17	0.48	0.75	0.12
<i>Totals for fruit</i>	<b>7.68</b>	<b>3.12</b>	<b>1.11</b>	<b>12.76</b>	<b>3.70</b>	<b>2.08</b>
Leaves. . . . .	0.20	29.42	4.80	16.14	3.06	4.62
Branches. . . . .	6.30	22.08	2.56	2.96	2.52	0.96
<i>Totals for leaves and branches</i>	<b>16.50</b>	<b>51.50</b>	<b>7.36</b>	<b>19.10</b>	<b>5.58</b>	<b>5.58</b>
<i>Totals (fruit, leaves and branches).</i>	<b>24.18</b>	<b>54.62</b>	<b>8.47</b>	<b>31.86</b>	<b>9.28</b>	<b>7.66</b>

(1) See also B. February 1917, No. 185.

The greater part of the nutritive matter is removed by the leaves and branches; the quantity removed by the fruit is much lower. The plum is less exacting in this respect than other fruit trees such as the peach, apple, etc. This explains its hardiness and its faculty for adapting itself to the majority of soils.

In districts where the plum is largely grown, the kernels might well be used for the extraction of the oil, the residue being employed as a feeding cake.

Numerous analyses made by the writers have shown that this oil is composed chiefly of the glycerides of oleic acid, those of linoleic acid and palmitic acid figuring in only a small proportion. Analysis has also shown the presence of a very feeble quantity of an unidentified phytosterin (vegetable cholesterol).

The oil shows a certain number of constants which only differ slightly from those of olive oil, consequently on mixing it with this latter in a certain proportion its presence is not easily detected. Owing to its properties and organoleptic qualities, it can be put to various uses and may attain quite favorable prices on the market.

640 - **Shallow Cultivation in Vineyards** (1). — BUCHARD, P., in *La Vie agricole et rurale*; Year 7, No. 18, pp. 312-314, 4 fig. Paris, May 5, 1917.

VINE GROWING.

In view of the ever-increasing difficulties of vine-growing in those countries engaged in war for nearly 3 years, shallow cultivation (*dry farming, culture Jean*, etc.) is now very generally adopted in vineyards.

If, instead of a plough, making a deep furrow, implements of shallow draught are used, the expense is much less, and the number of the necessary staff, horses, implements, together with the cost of their upkeep, are diminished.

The soil is not stirred to nearly so great a depth as with a plough, but it is possible to repeat the process frequently, which cannot be done when a plough is used. By this method grass does not have time to develop, nor the ground to harden; the arable layer gradually deepens, all traces of grass disappear, cultivation becomes easier and the plant grows more vigorously.

A detailed description of the implements required for the shallow cultivation of the vine is given.

*Disc harrows*, of Canadian origin, may be used as clod-breakers, cultivators and for fallowing. They are composed of spherical or conical disks fixed on two axes in the same horizontal plane; by adjusting these axes, greater or less pressure may be obtained.

*Spring-tine cultivators* raise the soil, thus breaking it up. The European form of this implement preserves the rigid frame of the scarifier, only replacing the ordinary stanchions by flexible pieces. For use among trees or vines it is advisable to fix two teeth outside the frame, so as to work as near to the trunks as possible without damaging them. For harder

(1) See B., 1914, No. 640.

(Ed.).



work the ordinary ends may be replaced by wide triangular blades, which answer the same purpose as those of the old type of cultivator. In America these tools are made with separate frames as well as with spring teeth. Some of these cultivators are mounted on a tilbury or tricycle, with a seat; others are made with frames in juxtaposition, at an invariable distance apart but capable of being displaced vertically in order to follow the rise and fall of the ground.

Mention is also made of the FROGER *combined machine for weeding, stirring up the earth round the roots of the plant and hilling up*, specially constructed for the cultivation of the vine. It consists of a frame with shafts for a horse, and can, therefore, be used for passages of any width. As it is very low it is possible to work beneath the branches, even when growth is fairly advanced. The frame is supported by two wheels by means of which the depth can be controlled. The stilts are fixed to the frame in front of the wheels by means of axles, and can be moved either horizontally or vertically and raised as the driver wishes. As the rectangular implement frame is connected with these stilts, when these are moved all the implements move simultaneously with them; they have a displacement of 12 inches on either side. This enables the machine to be driven with perfect security and greatly facilitates working at the sides, since, by means of the stilts, the direction may be corrected and the implement frame kept in the desired position. A great variety of instruments may be fixed on to this frame, picks, coulter with rigid or spring teeth, discs, or a vineyard plough.

This arrangement allows all the ground to be turned, including the intervening spaces on either side. When using this combination the plants must be very straight and regularly planted. If, however, a vineyard plough is fitted on to one side only, the work may be carried out with perfect safety among low, irregularly growing plants.

The following method of shallow cultivation has been used by MR. GAVOTY for many years in the Var district :

The superficial roots of the vine are left because, as they are in closer and more fertile soil, they feed the plant most efficaciously. It is, therefore, only necessary to scratch the soil in order to suppress weeds and to keep the ground fresh.

At the beginning of November, as soon as the grapes are gathered, the vines are pruned, care being taken to keep the crown of the plant a sufficient height above the ground (about 14 inches), so that the hoe may pass close to the foot of the vine and that the frame may not be obstructed.

In December and January pruning is continued, the dead plants replaced and the superfluous American branches removed with a very sharp tool (*cissadou*). This tool may be used by a woman and, with it, the very small space round the shoots may be stirred. The "*cissadou*" is only used for vines with superfluous branches.

At the beginning of February hoeing is begun, and the work of scratching the soil continued till harvest time. Various blades are used on the hoe. In the first case spoon-shaped blades, which only scrape the earth, are used. Later, more or less flat triangular shares are fixed. These cut the earth to a greater depth which, however, never exceeds a couple of inches.

641 - Cultivation of the Vine by the Desbois Method. — GRANDCLÉMENT in *La Vie agricole et rurale*, Year 7, No. 18, pp. 316-317, Paris, May 5, 1917.

The DESBOIS method of vine cultivation consists essentially of 3 things:

1) *Retention of the fruit and wood shoots* throughout their whole length, and ringing off all the eyes occurring beyond the 8 or 10 which are kept for fruit and the 2 left for wood. This method gives double the quantity of sap for the eyes that are retained than the usual method of pruning, which simply severs the branches beyond these buds. There is, therefore, no ground for surprise if, having received double nourishment, the future branches have double the quantity of wood and bear a double amount of leaves and grapes. Removal of the eyes is the new and essential point of the DESBOIS method.

2) In summer *repeated ringing of the terminal bud of the fruit branches* is effected, an operation which increases the effect of the winter removal of eyes; it accumulates a further quantity of sap in the leaves and fruits of these branches which would otherwise go towards lengthening the branches and producing a useless quantity of wood.

3) The third point is the most important and is distinctly original: it consists in the retention of the fruit branch for 3 years in succession. This branch, which is only in the herbaceous state in the 1st. year, reaches in the second year a markedly woody condition resulting in very strong, well-lignified roots which the phylloxera are unable to penetrate, and which, consequently, are obliged to go deep down into the soil to obtain their food. During the 3rd. year these roots become still stronger, thanks to the retention of the fruit branch, which remains alive for a good portion of the summer in spite of having been deprived of all its buds and branches. — The next 3-year cycle in turn reproduces roots producing magnificent fruiting branches.

There is nothing to prevent, in addition to all these operations, the practice of *ringing*, effected before the flower appears, towards the base of the fruit branch. This will still further increase the quantity of leaves and fruit. These combined operations will prevent the fruit from dropping, etc. Fungoid diseases will be held in check much more efficiently with two or three sulphurings only, the first one always being made very early, at the beginning of May, and a single treatment of the flowers effected with a finely powdered mixture of sulphur and lime. M. DESBOIS attaches considerable importance to lime for preserving the flower and keeping it healthy.

This system does not imply any absolute necessity for the vines to be trained along wires at a height of 2 metres; it can be made to apply to such vines as those of Beaujolais for instance, which only have low props. It suffices to follow the method as far as possible, not to copy it minutely. While retaining the props, an endeavour should be made to keep the aerial portions of the plant as long as possible, by keeping each of the three branches which bear 2 eyes at their full length, and removing all the eyes occurring above the 2 retained at the lower end, up to a height corresponding to the point of the prop.

In this way the production will be doubled in the first year of the 3-year cycle. The second year the branch, which has now become woody, can be retained and attached to the prop, and on it there can be left 2 shoots pruned to 3 eyes, the third one now being removed. As it grows older and becomes stouter, this branch will support the prop and may even replace it, a point which may be of considerable advantage. It can be retained



for several years until it can be replaced by a new fruit branch which has withered in its turn.

By means of the DESBOIS system, properly applied, vines may be kept indefinitely with the minimum expense and labour.

M. DESBOIS has a special method by which he can obtain plants, with extraordinarily strong root development, capable of producing half a crop in the first year of their final planting. The method, called *transfusion of sap*, is as follows :

At pruning time, he selects, aside from those which are to act as carriers, one or more shoots from a fine stock ; these shoots should be at least 1 metre long. A little time before the awakening of growth, by means of a wooden stake or peg, along the line of the stocks about 30 or 40 cms. from the mother stock, he makes a hole deep enough to introduce in an upright position the extremity of the shoot, the length of which should not exceed 4 eyes, in such a way that the 4th. eye, viz. the one nearest the surface of the soil, should be about 6 to 8 cms. below this latter.

The extremity of the shoot is fixed at the bottom of the hole, leaving the three eyes buried in the earth at the bottom, the *fourth eye* being, with the utmost care, allowed to remain free 6 to 8 cms. below the soil surface.

When the buds begin to swell, all the eyes of the shoot so bent back are suppressed, with the exception of the two nearest the stock and the one which is to give rise to the subject (fourth). When the little stem of this latter begins to project above the soil surface it should be covered with a thin layer of earth. When it has reached a length of 30 cms., the growth of the young subject should be stopped by suppressing the terminal eye of the shoot which is to form it. This operation of ringing the terminal eye of the little stem will occasion at that point the formation of a collar or vital node which will give rise, like a seed, to a complete root system, which in its first year will give off tap-roots of very great vigour. The plants with these roots, detached from the mother stock, may be finally planted in the autumn of the same year. They will give a half-crop the first year and a nearly full crop the second.

642 — Observations on the Cultivation of the Vine "en Asmas", in Bulgaria. — See No. 697 of this *Bulletin*.

#### FORESTRY

643 — Influence of the Perennial Lupin on the Development of Forest Trees. — Trials in Bohemia. — NAWRATIL, K., in *Centralblatt für das gesamte Forstwesen*, Year 42, Parts 5-6, pp. 178-180. Vienna, 1916.

Fifteen years ago, in the forest district of Haid (Western Bohemia), the writer began an experiment to test the influence of the perennial lupin (*Lupinus perennis* L.) on the development of forest trees in mediocre soils. Two plots were planted with spruce, one with and one without lupin.

Later, it was evident that the plot with lupin was making stronger growth than the other : thus, 10 years after planting (1911), the trees in the lupin plot were 1.63 metres high against a height of 1.02 m. only for those in the plot without lupin ; both lateral branches and needles of the former were longer than those of the second plot. These differences were confirmed during the period 1911-1916. The accompanying Table summarises the observations made upon this subject.



The excellent effect of the perennial lupin would be due to the following causes :

1) In mediocre soils, the lupin ensures retention of moisture and of the chief fertilising elements indispensable to young plants.

2) The lupin enriches the soil in nitrogen.

3) Thanks to its rapid growth, it quickly covers the soil and clears out weeds, especially heather : by employing 12 to 20 kg. of lupin seed per hectare, the soil is well covered in 2 to 3 years.

*Differences observed between spruce trees on plots with and without lupin.*

	Average lengths of annual shoots of lateral branches		Average lengths of needles	
	Plot <i>without</i> lupin 9 trees	Plot <i>with</i> lupin 8 trees	Plot <i>without</i> lupin 10 trees *	Plot <i>with</i> lupin 8 trees **
	31 mm.	110 mm.	7.6 mm.	14.8 mm.
	36	110	6.4	11.8
	42	110	7.4	13.3
	36	96	11.9	12.3
	28	89	8.7	14.1
	20	90	8.6	12.8
	25	97	8.1	12.8
	29	95	7.4	12.6
	31	—	7.7	—
	—	—	8.5	—
<i>General averages</i>	<b>31 mm.</b>	<b>100 mm.</b>	<b>8.2 mm.</b>	<b>13.1 mm.</b>

\* Needles faultily developed, colour varying from light green to yellow.

\*\* Needles well developed, dark green colour.

## LIVE STOCK AND BREEDING.

644 - Anaphylaxis in Cattle and Sheep, Produced by the Larvae of *Hypoderma bovis*, *H. lineata* and *Oestrus Ovis*. — HADWEN, SEYMOUR and BRUCE, E. A. in *Journal of the American Veterinary Medical Association*, Vol. LI, New Series, Vol. 4, No. 1, pp. 15-44, 15 plates, Ithaca N. Y. April, 1917.

Anaphylaxis has been described by MUIR and RITCHIE (1910) as development under certain circumstances in an animal of hypersensitiveness to foreign albuminous materials which in themselves are not essentially toxic. The common feature is that repeated injections of certain substances in sub-toxic or non-toxic doses — a suitable interval of time elapsing between the injections — may be followed by markedly toxic or even fatal symptoms. The writers have obtained such reactions in cattle,

sheep and small animals by injecting them with extracts of the larval forms of *Hypoderma lineata*, *H. bovis* and *Oestrus ovis* from their own bodies. They have also observed natural cases of anaphylaxis where, owing to injury, the larvae have been ruptured subcutaneously *in loco*. As extracts of *Hypoderma* larvae contain little or no toxic material the reaction is regarded as being due to the development of hypersensitiveness in the host to the protein material of its parasite.

Anaphylaxis may be either "acute" or "chronic". The symptoms in the first case were immediate, the first noticeable sign being an extremely tired look, succeeded almost immediately by salivation, tears and defaecation, then by signs of asphyxia and death. In the "chronic" form the symptoms were a little less rapid and not so severe, in addition there were oedemas, especially of the eyelids and anus, and marked irritation of the skin.

Small animals were sensitized with warble extracts and showed signs of anaphylaxis following the second injection.

Eye and other local reactions were obtained with extracts applied to the mucous membranes. In cattle the reaction was specific for extracts of *Hypoderma*, and in a horse for *Gastrophilus*.

It would appear probable that similar reactions will be obtained in other animals with their own parasites.

- 645 - **A Study of Hemorrhagic Septicaemia, Observations in Sheep and in Mouflon-Sheep Hybrids.**—MORI, NELLO (*Director of the Naples Experimental Station for Infectious Diseases of Livestock*) in *Annali delle Stazioni Sperimentale per le malattie infettive del bestiame*, Vol. III, part II. 33 pp. Naples, Year 1916.

The clinical nature of Hemorrhagic Septicaemia of sheep has been known for some time past but owing to association in many cases with worm parasites of lung and stomach its true nature is often mistaken. The present study is based on material from the Naples Veterinary School and other districts of S. Italy.

**SYMPTOMS AND ANATOMICAL LESIONS.**—Animals listless, somewhat disinclined to eat, marked oscillations of temperature, discharge from nose, cough, faeces soft but no actual diarrhoea, limping (preferably hind limbs affected). Later, anaemia rapidly becoming very serious, with progressive loss of weight.

The disease generally required 15-25 days to run its course; in some cases 2-3 months and affected Abyssinian sheep, merinos and mouflons.

Mucous surfaces of shining white appearance, resembling porcelain, gelatinous subcutaneous exudates in relation with lymphatics of inguinal region, in some cases signs of intestinal catarrh; the liver might or might not show lesions from flukes. No Strongylids were found. Frequently serofibrinous pleurisy phenomena and almost always foci of pulmonary inflammation with sero-gelatinous infiltrations sometimes extending over the entire lung apex which as a result took on the appearance of a piece of amber.

In the pericardium was frequently found a lemon-coloured or sero-hemorrhagic exudate, occasionally a gelatinous exudate surrounding the



heart, especially about the auricles; upon the wall of the pericardium occurred more or less numerous ecchimoses, these were also noticed in some cases upon the endocardium.

The blood was thin. In some cases signs of bronchial catarrh were seen; the peribronchial ganglia of a reddish tinge and in such cases surrounded by a gelatinous exudate. In one case of an Abyssinian goat *polyserosity* was observed.

The above account corresponds to a subacute and a chronic form of the disease. There is also an apoplectic and an acute form, the former ending fatally in a few hours, the latter accompanied by nervous phenomena and distinct symptoms of pleuropneumonia.

LOSSES DUE TO THE DISEASE. — These are fairly high. At the Naples Institute 12 sheep died out of a total of 25. Apart from death loss occurs from impaired milk yield, abortion and marked diminution, in weight.

ETIOLOGY. — The cause of the disease is a polymorphous bacterium resembling that causing hemorrhagic Septicaemia in other animals.

BACTERIOLOGY. — The following is a summary of the chief characters of the specific bacterium.

Non-motile. Markedly polymorphous; ovoid, isolated or united in short chains when derived from tissues of sick animals whether sickness occurred naturally or was produced artificially; but assuming different forms in artificial culture media. GRAM positive. Acid-resistant neither to the ZIEHL-NEELSEN nor to the ZIEHL-MORI method. No cilia. No definitely colorable capsule though in organic juices shows a distinct halo. Non-sporing.

*Cultural Characters.* Preferably aerobic. Optimum development at 37-38° C. Grows well in an alkaline medium but can accustom itself to neutral or slightly acid media. Gelatine not liquefied. No growth on potato slopes.

*Biochemical Characters.* — No acid, no alkali in neutral broth. In peptonized broth formation of  $H_2S$  in 24 hours. Positive, though feeble, reaction with SALKOWSKI'S, GRIMBERT'S and CRISAFULLI'S method (Indol test). Reduces nitrates. Does not secrete trypsin. Does not coagulate milk. Tryptophane reaction negative. No effect on saccharose, mannite, dextrin, glycerine and rice starch.

*Conservation of vitality and virulence.* Broth and agar cultures at room temperature have retained their vitality for 65 days. Infected blood in flame-sealed capillary tubes kept at room temperature gave evidence of vitality up till the 5th. month. Cultures in broth and agar transplanted to the same media every 30-40 days, retained their initial virulence practically intact for 8-12 months.

*Resistance to Dessiccation, Sunlight and Heat.* — Germs dried on wood, silk and platinum were dead after 8 days, on linen they resisted till the 10th day, on wool till the 12th, on blotting paper till the 18th day.

Extremely thin films of 2 day-old broth cultures on glass cover slides were filtered, dried, placed with the usual precautions in closed Petri dishes



and exposed to the direct rays of a July sun at midday. Two to three minutes were invariably sufficient to kill the germs.

Broth cultures (24 hours) were closed in extremely thin capillary tubes and immersed in the water bath. 5 minutes at 55° C. were always sufficient to kill the germs; and 10 minutes at 50° C. nearly always so.

*Inoculation Experiments.* — The account of these is given in detail. Results varied.

*Agglutination tests.* — Proof was obtained of the agglutinability of strains of bacteria of hemorrhagic Septicaemia of other animal species through the agency of the immune-serum prepared with *B. ovisepticus*.

This is evidence of the mutual relationship and justifies the interpretation that they are to be regarded as races of a single bacterium derived through acclimatisation in organisms of another species.

*Treatment and Prevention.* — LIGNIÈRES (*Boletín del Ministerio de Agricultura*, Vol. VI, Nos. 1, 2 and 3. Buenos Aires, 1906) has evolved a treatment based upon the employment of various antiseptic and vermifugal substances, i. e. creosote carbolic acid and naphthaline with camala and aqueous or ethereal extract of male fern, owing to the fact that worms are often associated with this disease.

As regards preventive methods, care should be taken not to introduce sick animals into the flock: often infection is derived from apparently healthy reproducers. No animals should ever be bought showing nasal discharge, whether from an infected region or not. Flocks should be allowed plenty of room. If the sheep are folded the food should be derived from healthy, dry localities; if at grass, damp low-lying pastures with stagnant water should be avoided. Drinking water must be from a perfectly healthy source. Where disease has already entered the flock, the pasture should be changed or, at least, the sick animals isolated.

LIGNIÈRES has prepared a polyvalent vaccine with 6 strains of bacteria of hemorrhagic Septicaemia which he claims is an efficient preventive. MESSNER and SCHERN, RAEBIGER, KLIEN and SEIBOLD have also prepared sera which have given encouraging results. Cases are also to hand where the specific treatment for symptomatic anthrax has been successful in arresting hemorrhagic Septicaemia. The writer appends to his paper a bibliography containing 14 references.

646 — *An Intradermal Test for **Bacterium pullorum** Infection in Fowls.* — WARD, ARCHIBALD R. and GALLAGHER, A., in *U. S. Dept. of Agriculture, Bulletin No. 517*, 15 pp. Washington, February 16, 1917.

Of the numerous diseases to which poultry are susceptible it is safe to say that bacillary white diarrhoea is the most destructive. Its ravages are confined principally to baby chicks, but it is the *pullorum* infection in the hen which is directly responsible for out-break of white diarrhoea in the chicks, since a certain percentage of her eggs hatch infected chicks and the excrement of these spreads the disease to the other birds in the brood. The exceedingly high mortality of white diarrhoea, amounting in some cases to almost 100 % of the hatch, practically prevents the rearing of

chicks in infected flocks. Chicks which recover may carry the causative bacterium in the ovary and serve as a source of infection in the future. Infected hens usually exhibit an ovary containing several angular, hard, discoloured ova; however, the organ may continue to function and from time to time an ovum is released which harbours the infective agent. Outbreaks of white diarrhoea as a result of contaminated incubators or brooders could be controlled readily by sanitary measures, but infection through the egg must be prevented by eliminating the infected birds.

As the presence of *Bacterium pullorum* in the ovaries is not revealed by any external symptoms, it has been necessary to have recourse to the biological method in order to diagnose the disease and it has been shown that the agglutination test may be so employed; however, the cost of this latter is relatively too expensive. The writers have therefore investigated a simpler method of diagnosis, less costly, equally accurate and very similar to the hypodermic tuberculin test.

Among the different biological products obtained from *Bacterium pullorum*, the one which gave the most satisfactory results was a broth culture of the bacterium kept for 1 month at 37° C., filtered and sufficient carbolic acid added to make a 0.5 % solution. This culture was tested on the fowls both in the laboratory and in the open.

It seems to be a fact that the edematous swelling resulting from the injection of the product into the wattle of a fowl, when observed at a proper interval of time, is an indication of the presence of infection of *B. pullorum* in the fowl.

The experience of the authors to date, with readings at various intervals of time, leads to the conclusion that the 24 hour interval has given the most accurate results. However, it seems desirable to test on a large number of birds the accuracy of readings made at a slightly longer interval.

The weight of evidence indicates that any perceptible swelling of the wattle should be regarded as significant. A second intradermal test made at an interval of 4 days gave results varying but little from the first test. Others made at intervals up to two months gave less accurate results the second time. Thus, there is no advantage in retesting.

Of birds artificially infected with the disease and tested in the laboratory, in round numbers 90 % gave positive reactions; and in 6 % the test failed to indicate a reaction when lesions were present. In 3 % no reaction occurred and no lesions were present.

In a field test on 231 birds made simultaneously with the agglutination test, the intradermal test at 38 hours failed to detect one case reported positive to the other test. In a second flock of 50 birds in which the two tests were compared, the intradermal test when read at 46 hours failed to indicate one case that was detected by the agglutination test. Another group of about 100 birds tested under unfavourable conditions gave less satisfactory results.

Forty-seven birds that had been tested by the agglutination method by the Connecticut Agricultural Experiment Station in the field were purchased for experiments with the intradermal test. Of these, 40 had given



positive reactions to the agglutination test and 7 doubtful reactions. There was complete agreement between the agglutination tests, the intradermal test, and autopsy findings in 70 % of the cases. The agglutination test reported positive in 3 cases, or 7 %, and was not confirmed by the intradermal test nor by the autopsy findings. Thus the percentage of absolute failures of each test was small, and very similar for both tests.

Autopsy does not furnish an absolute standard for comparing the accuracy of tests. 72 % only of naturally infected birds that had reacted to one or both tests were found on autopsy to be unmistakably infected.

The intradermal test detected the presence of infection in 4 of the 34 control birds injected in connection with the tests in the laboratory on artificially and naturally infected birds.

In a field trial not made by the writers, 1301 birds were tested intradermally and 78 reacted. Of these 70 reacted to the agglutination tests made subsequently.

The intradermal test has already shown sufficient promise to warrant further extensive trials in the field in comparison with the agglutination test.

647 - Relation between the External Body Measurements, the Live Weight and the Net Weight on the One Hand, and the Weight of the Heart and the Lungs on the Other Hand, in Cattle of the Schwytz and Parmesan Breeds; Investigations carried out in Italy. — BRENTANA, DOMENICO, in *Il Moderno Zootatro*, Series V, Year VI, No. 3, pp. 61-79. Bologna, March 5, 1917.

The modern works on the relation between the body measurements, live weight, etc. on the one hand and the weight of the heart and the lungs on the other, in domestic animals and in man, are summarily reviewed. The author then describes his own experiments at the public abattoir of Parma on 84 cattle, giving, in 4 tables, the results of his measurements and calculations. The minimum, maximum and average figures obtained are summarised in the appended table. The author came to the following conclusions :

1) The total weight of the lungs and heart tends to increase with the increase in live weight, but is not proportionate to this latter, which increases more rapidly, especially in relation to the weight of the lungs. This fact is further demonstrated by the progress of the relative weights of the heart and the lungs, which tend to increase as the live weight decreases.

There is also a certain relation between the increase in weight of the heart and that of the lungs.

2) The relation between the proportionate produce at slaughtering and the weight of the lungs and the heart is not very clear. BAUDEMONT'S theory that, all else being equal, the relative weight of these organs is lowest in animals in best condition, seems nevertheless to be confirmed.

3) The constancy of the ratios

$$\frac{3 \sqrt{\text{weight of lungs}^2} \times 100}{3 \sqrt{\text{live weight}^2}} \text{ and } \frac{3 \sqrt{\text{weight of heart}^2} \times 100}{3 \sqrt{\text{live weight}^2}}$$



	Schwytz Cows			Schwytz Bulls			Parmesan Cows			Parmesan Bulls		
	Average	Maxi- mum	Mini- mum	Average	Maxi- mum	Mini- mum	Average	Maxi- mum	Mini- mum	Average	Maxi- mum	Mini- mum
Live weight . . . . .	495	670	380	670	790	640	488	580	400	612	760	480
Weight of lungs . . . . .	3840	4200	3250	5040	6000	4000	4580	5100	3400	4940	5500	4150
Weight of heart . . . . .	2380	2900	1970	3040	3800	2400	2580	2900	1800	2940	3950	2230
Net weight . . . . .	246	378	196	385	530	290	238	270	200	329	412	250
Grammes of lung per 1 kg. of live weight. . . . .	7.90	9.70	6.10	7.50	8.80	6.50	9.41	11.10	8.25	8.05	8.65	7.12
"    "    "    "    "    "    "    "    "    "    "    "    "    "	15.25	19.80	10.80	13.25	15.80	11.30	19.20	22.70	16.05	15.00	16.80	13.05
"    "    "    "    "    "    "    "    "    "    "    "    "	4.90	5.60	4.30	4.55	5.60	3.80	5.30	5.92	4.50	4.80	5.35	4.55
"    "    "    "    "    "    "    "    "    "    "    "    "	9.50	11.50	7.70	7.95	9.30	6.70	10.83	12.10	8.70	9.00	10.15	8.00
Height of withers . . . . .	131	135	120	146	157	136	137	140	126	149	154	142
Relative index of lungs . . . . .	12.00	13.40	11.60	11.60	12.50	10.90	12.08	12.82	11.31	11.35	11.80	10.85
"    "    "    "    "    "    "    "    "    "    "    "    "	10.20	11.30	9.80	9.00	10.70	9.10	10.00	10.30	9.70	9.55	10.40	8.90
Size of thorax . . . . .	46	58	42	53	63	46	43	47	38	50	59	43
Relative index of lungs . . . . .	33.40	40.20	28.00	32.20	38.40	26.60	38.50	41.40	36.40	34.10	41.50	31.00
Height of thorax . . . . .	88	73	62	77	82	72	70	73	66	77	84	75
Relative index of lungs . . . . .	23.20	25.10	21.30	22.10	24.00	21.10	23.65	25.50	22.00	22.10	24.00	20.05
"    "    "    "    "    "    "    "    "    "    "    "    "	19.90	20.70	18.60	18.70	19.80	17.20	19.50	20.35	18.50	18.70	19.90	17.30
Length of trunk . . . . .	167	184	155	179	191	161	172	183	167	179	200	168
Relative index of lungs . . . . .	9.40	10.50	8.70	9.60	10.30	8.90	9.60	10.00	9.00	9.50	9.95	8.95
"    "    "    "    "    "    "    "    "    "    "    "    "	8.00	8.60	7.50	8.05	8.50	7.40	7.90	8.40	7.30	8.00	8.15	7.70
Perimeter of thorax . . . . .	191	213	175	216	235	200	193	198	177	212	225	200
Relative index of lungs . . . . .	8.20	8.70	7.40	7.95	8.40	7.50	8.55	9.05	8.23	8.00	8.35	7.45
"    "    "    "    "    "    "    "    "    "    "    "    "	7.00	7.20	6.50	6.70	7.10	6.20	7.06	7.40	6.50	6.75	7.00	6.40
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3 $\frac{\text{Weight of lungs} \times 2}{\text{Live weight} \times 100}$ . . . . .	4.04	4.80	3.40	3.85	4.35	3.60	4.45	5.00	4.10	4.00	4.20	3.70
<hr/>												
3 $\frac{\text{Weight of heart} \times 2}{\text{Live weight} \times 100}$ . . . . .	2.09	3.20	2.70	2.72	3.15	2.45	3.04	3.30	2.75	2.84	3.05	2.75
Yield at slaughtering . . . . . %	51.5	56	45	57	61	52	49	52.00	45.00	53.80	58.50	47.50

is of interest ; it is much greater than the ratio observed between the live weight and the weight of the heart and the lungs. This corresponds with the observations which have been made concerning organic combustion as compared with the weight and surface of the body ; according to LAULANIE, all else being equal, the intensity of combustion increases more slowly than weight, following the increase in surface very closely.

4) With regard to differences in the various breeds and in sex, the average observations show that, in the Schwytz breed, the total weight of the heart and lungs is greater in bulls than in cows, whereas, in the latter the relative weight is greater. Similar differences occur between bulls and cows of the Parmesan breed. As compared with Schwytz bulls, Parmesan bulls show a smaller total weight of the heart and the lungs, and a greater relative weight of the same organs. Parmesan cows show both a greater total weight and a greater relative weight of the heart and the lungs than Schwytz cows.

If, instead of the averages, comparison is made between the absolute and relative weights of individuals of about the same live weight, it will be seen that these are greater in the Parmesan than in the Schwytz breed ; as regards sex, the total and relative weights are greater in the males than in the females. These observations, on the one hand, confirm the theory that the heart and lungs tend to increase with the live weight, and on the other hand, they correspond to the different capacities of the Schwytz and Parmesan breeds and the greater fitness of the latter for work. The differences between the sexes may be considered analogous to the intensity of the respiratory exchanges which, other things being equal, are greater in the male.

5) As a rule, the heart indices are more constant than the lung indices. The indices with the greatest constancy are those relating to the length of the trunk and the thoracic perimeter.

648 - **The Mineral Metabolism of the Milch Cow.** — FORBES, B. and BEEGLE, F. M., in collabor. with FRITZ, C. M., MORGAN, I. E. and RHUE, S. N., in *Ohio Agricultural Experiment Station Bulletin* No. 295, pp. 323-348. Wooster, Ohio, April 1916.

The dairy cow greatly excels any of the other farm quadrupeds in the rapidity and efficiency with which she produces proteid and mineral nutriment. Her unusual requirement for protein in the ration is universally recognized and receives that attention which its importance demands.

The mineral requirements of the milch cow, however, have received but scant recognition. In the literature there is almost no evidence on the subject, and it is ordinarily assumed that cows get enough mineral matter in the ration at all times. The results of this experiment on the mineral metabolism and requirements of milch cows show that this assumption is not right.

The mineral income and outgo of the milch cow was studied on common practical rations, especially as influenced by the protein concentrates and by the type of roughage fed.

The rations fed were the following :

Corn, cottonseed meal, timothy hay, corn silage,



Corn, cottonseed meal, clover hay,  
Corn, cottonseed meal, clover hay, corn silage,  
Corn, distiller's grains, clover hay, corn silage,  
Corn, linseed oilmeal, clover hay, corn silage,  
Corn, gluten feed, clover hay, corn silage.

These rations afforded a basis for the comparison of clover and timothy hay, and of the common commercial nitrogenous concentrates.

The investigation was conducted during January, February and March 1915, by the usual method of the metabolism experiment, involving the collection, sampling and analysis of food, urine, fæces and milk.

Six cows were purchased for this investigation. Five of them were grade Holstein-Friesians, and one was pure-bred. The cows were from 3 to 5 years of age, and all were fresh from 4 to 6 weeks before the experiment began.

After a preliminary feeding of 3 weeks to accustom the cows to the place, the rations and the routine, the experiment began on January 8. The experiment covered three collection periods mostly of 19 or 20 days' duration, separated by 10 day intervals on the feed of the next period to follow, the changes in the rations being made abruptly at the beginning of the intermediate periods.

The records taken during the experiment were the following: the average daily amounts of foods consumed; the milk produced; the live weights of the cows; the composition of foods and milk; the amounts of the several constituents of the rations, milk, urine and fæces; the average daily amount of each of the constituents determined in the food, milk, urine and fæces, and the final balance of income and outgo for each; the computation of the mineral acids and bases of the food-stuffs to cubic centimeters of normal solution of the respective elements; the relation of urinary ammonia, phosphates and sulphates to the balance of mineral acids and bases in the rations, and the coefficients of digestibility of the rations.

The balance data summarized in the appended table, show that the intake of common salt, about 1 ounce per head per day, was usually sufficient along with the sodium and chlorine of the rest of the ration to maintain sodium and chlorine equilibrium, though there were 4 negative sodium balances and 5 negative chlorine balances out of 18 of each.

Of the potassium balances 5 out of 18 were negative. Without exception there was a loss of calcium and magnesium, and in 15 cases out of 18, a loss also of phosphorus.

The results show that there was with each cow, on every ration, a retention of nitrogen, and in all but 2 cases out of 18 a retention of sulphur, these facts indicating that the rations provide nutriment sufficient in amount, and of the right kind to protect and to increase the protein tissues of the cows. This condition, taken in connection with the fact that all the cows but one gained in weight, shows that the losses of calcium, magnesium and phosphorus were not due to general under-nourishment, but that for some unknown reason the animals were obliged to draw upon their skeletons in the production of milk.



The balance data also demonstrate the existence of an extensive metabolism of silicon, the retention of this element from the first ration, which contained timothy hay, being surprisingly large. This storage of silicon may have taken place through the growth of hair, the ash of which contains silicon in considerable quantity. No silicon was found in the milk, but quantities of it were found in the urine.

From these results it appears that failure to maintain mineral equilibrium must be so common among cows of the more profitable sort that it must be considered a normal condition during the time of larger production, at least if this occurs during the winter, that is, while the cows are not on pasture. The writers are led, therefore, to look for results of such losses, in the behaviour of cows under usual methods of management.

The effects of these losses are observed most noticeably under those conditions which tend to accentuate them, thus malnutrition of the bones is common in regions of unfertile sandy soils, or soils of granitic origin, especially if these be worn through long cropping with insufficient fertilization, and also after seasons of drought, overstocking of pastures and deficient food supply.

It is not necessary, however, to go into the field of pathology for instances of the practical bearings of the main point determined by this investigation. Under the best conditions of feeding and management, as understood by practical feeders, a cow often fails to breed during the season following one in which she has been fed for a record of high production. It seems quite probable that the excessive lactation has depleted the mineral reserves of the body to such an extent as to disturb the reproductive functions. Such a depletion is also reflected in the fact of the failure of many cows fed for high production to maintain high records during two consecutive periods of lactation.

In all probability the most important results of a failure of heavy-milking cows to maintain mineral equilibrium are not in such prominent effects, but in an inconspicuous shrinkage of lactation in cows which are apparently in normal condition. Since milk production, in cows such as were used in this experiment, seems to be sustained in part by drafts upon the body reserves, and since this process cannot continue indefinitely, and since there is in cows a gradual shrinkage and final cessation of milk production coincident with this depletion of nutrient reserves it is believable that this exhaustion of reserves should be among those factors which cause the gradual shrinkage of milk flow, and that by preventing as largely as possible these losses from the body the shrinkage may be lessened and the duration of the production of milk extended. The time of replenishment of reserves comes, of course, during the latter part of the period of gestation. This process of repair is most efficiently accomplished while the cows are on pasture, particularly if the pasture contains a considerable proportion of leguminous vegetation.

These balance data also indicate that after a certain level is reached in food consumption and milk production, the digestion of the additional mineral nutriment demanded by further increase in milk secretion is

TABLE I. — *Average Daily Feed, Milk, Live Weight and Balance Data from Six Cows.*

Cow No.	Period and days	Rations (Pounds)	Milk yield	Gain or loss to the body. (Grams)										Nitro- gen								
				Live weight	Sodium	Potas- sium	Calcium	Magne- sium	Sulphur	Chlorine	Phos- phorus	Silicon										
			lbs.																			
1	I 19	Corn 9.37; cottonseed meal 2.56; timothy hay 7.98; corn silage 25.00; salt 0.053.	40.58	— 78.5	— 2.343	+	1.528	— 25.035	—	7.089	—	3.624	— 0.496	—	4.661	+	15.617	+	11.485			
2	I 19	Corn 9.48; cottonseed meal 2.73; timothy hay 7.98; corn silage 30.0; salt 0.062.	38.55	— 771.4	+	3.861	+	4.272	— 17.083	—	2.964	+	2.531	+	1.697	%	0.113	+	19.259	+	34.274	
3	I 19	Corn 8.32; cottonseed meal 2.74; timothy hay 11.992; corn silage 25.00; salt 0.051.	43.77	— 800.0	+	8.003	+	3.000	— 187.88	—	4.836	+	2.080	—	1.610	+	24.925	+	29.191			
1	I 10	Corn 9.53; cottonseed meal 1.80; clover hay 8.99; salt 0.056.	32.67	0.0	— 0.118	+	5.759	— 17.039	—	1.258	+	0.141	+	0.999	—	1.593	+	0.045	+	30.935		
2	I 10	Corn 9.95; cottonseed meal 1.80; clover hay 8.99; salt 0.056.	31.65	— 360.0	— 0.375	+	4.180	— 16.114	—	2.667	+	0.291	+	0.841	—	2.426	+	1.153	+	11.247		
3	I 10	Corn 9.50; cottonseed meal 1.80; clover hay 8.99; salt 0.056.	33.97	— 240.0	+	1.305	+	0.480	— 18.182	—	2.969	—	0.577	+	2.597	—	3.284	—	0.101	+	8.679	
1	II 20	Corn 6.61; cottonseed meal 2.20; clover hay 10.00; corn silage 25.00; salt 0.062.	40.70	— 100.0	+	5.769	+	2.920	— 14.599	—	6.529	+	0.386	+	0.536	—	0.924	+	5.284	+	20.073	
2	II 20	Corn 6.61; cottonseed meal 2.20; clover hay 10.00; corn silage 25.00; salt 0.062.	36.34	— 480.0	+	0.491	+	2.874	— 94.33	—	4.925	+	0.519	—	0.949	—	1.801	+	4.731	+	20.760	
3	II 20	Corn 6.61; cottonseed meal 2.20; clover hay 10.00; corn silage 25.00; salt 0.062.	41.02	— 253.0	+	5.906	+	3.464	— 95.27	—	5.029	+	0.242	—	1.872	—	2.354	+	4.959	+	43.399	
1	II 20	Corn 5.00; distiller's grains 3.81; clover hay 9.00; corn silage 12.00; salt 0.062.	31.58	— 187.0	+	4.865	+	0.136	— 17.596	—	4.068	+	1.135	+	1.593	—	2.866	+	3.740	+	9.892	
2	II 20	Corn 5.00; distiller's grains 3.81; clover hay 9.00; corn silage 12.00; salt 0.062.	32.61	— 440.0	+	2.380	—	0.020	— 17.198	—	4.771	+	0.750	+	1.557	—	3.288	+	5.088	+	2.788	
3	II 20	Corn 5.00; distiller's grains 3.81; clover hay 9.00; corn silage 12.00; salt 0.062.	35.06	— 7.0	+	2.145	—	1.265	— 17.354	—	4.639	+	0.941	+	0.454	—	2.471	+	1.604	+	4.620	
1	III 20	Corn 6.61; linseed oilmeal 2.76; clover hay 10.00; corn silage 25.00; salt 0.062.	39.25	— 327.0	+	6.387	—	2.142	— 14.678	—	3.952	+	0.344	+	1.666	—	1.837	+	3.344	+	5.664	
2	III 20	Corn 6.61; linseed oilmeal 2.76; clover hay 10.00; corn silage 32.00; salt 0.062.	33.57	— 620.0	+	3.095	+	0.474	— 14.185	—	5.162	+	0.913	+	1.008	—	0.329	+	10.814	+	9.988	
3	III 20	Corn 6.61; linseed oilmeal 2.76; clover hay 10.00; corn silage 32.00; salt 0.062.	40.09	— 7.0	— 2.136	+	1.027	— 12.555	—	2.944	+	0.735	+	0.235	+	1.867	+	12.445	+	9.124		
1	III 20	Corn 5.00; gluten feed 3.79; clover hay 10.00; corn silage 20.00; salt 0.062.	31.91	— 580.0	— 17.875	+	1.076	— 13.038	—	3.781	+	1.327	+	0.985	+	0.156	+	5.098	+	2.887		
2	III 20	Corn 5.00; gluten feed 3.79; clover hay 10.00; corn silage 24.00; salt 0.062.	33.07	— 553.0	+	20.941	—	0.514	— 16.784	—	3.886	+	1.474	+	1.426	—	2.224	+	4.600	+	9.849	
3	III 20	Corn 5.00; gluten feed 3.79; clover hay 10.00; corn silage 24.00; salt 0.062.	33.60	— 453.0	+	20.702	—	6.832	— 14.923	—	5.009	+	1.574	—	0.331	—	1.205	+	4.147	+	9.664	



accomplished at such a decreasing rate of efficiency, that the only practicable method of meeting mineral requirements is through the destruction of bone tissue. This overdraft should then be made good as soon as practicable and a liberal supply of foods which are rich in these elements should be allowed after the cow has ceased to produce abundantly, during the latter part of the period of lactation, in order to refund previous overdrafts before the birth of the next calf. The further study of this problem is now under way.

No important specific effects were observed of the nitrogenous concentrates, cotton seed meal, linseed oilmeal, gluten feed and distiller's grains, on the digestibility of the rations in which they were fed.

FEEDS  
AND FEEDING

649 - **By-Products from the Manufacture of Tin Plate** — *The Board of Agriculture of Ohio*, Vol. VII, No. 4, pp.65-66. Columbus, Ohio, Nov., 1917.

In the process of preparing tin plate for market it is necessary to subject the plate to a scouring action which is accomplished by the use of some cereal middlings (usually wheat) and palm oil. Until the last three or four years this mixture of palm oil and wheat middlings was discarded after it had served its full purpose in the polishing machine, but it having been discovered that animals ate it with relish and with profitable results, it has now been added to the list of commercial feeds and is being sold in the United States as "Palmo Midds". As originally manufactured, the mixture from the polishing machine was merely sifted through a sieve by hand labor and that passing put on the market. This process having proved ineffective in removing slivers, slugs, splashes, etc., a special automatic electro-magnetic separator was designed. Results of an investigation recently completed by the Indiana State Chemist's Laboratory confirm the belief that with the new process of manufacture the deleterious material heretofore found in refuse cleaning will be removed and that this product will become a valuable addition to American concentrated food stuffs.

650 - **A Contribution to the Bacteriology of Silage.** — SHERMAN, J. M. (Bacteriological Laboratories of the Pennsylvania State College and Agricultural Experiment Station). *Journal of Bacteriology*, Vol. I, No. 4, pp. 445-451. Baltimore, 1916.

The fermentation which ensilage undergoes during its curing process was looked upon a few decades ago as being entirely of microbic origin; at the present time, opinion has swung in the opposite direction to such an extent that micro-organisms are now generally considered of little, if any, significance in the normal fermentation of silage.

The notes recorded in the present paper have been made on ensilage during 1915 and suggest the probable importance of a group of acid-tolerant, acid-producing bacilli in the curing of corn silage. The organism concerned, while closely related to the *Bacillus bulgaricus* group of milk and the *B. acidophilus* group of the intestines, appears to differ somewhat from the typical members of these groups, notably by its comparatively abundant growth on ordinary laboratory media.

The microscopic examination of silage juice demonstrates the pre-



sence of immense numbers of bacterial cells (always over one billion per cubic centimeter), most of which are bacilli which resemble morphologically the high acid producing bacilli described above. The aciduric bacilli of silage are constantly found in quite large numbers on corn fodder, so that silage made from corn is always amply seeded with these organisms.

A bibliography of 17 references its appended.

651 - **Effects of Feeding Cottonseed Products on the Composition and Properties of Butter.** — ECKLES, C. M. and PALMER, I. S., in *University of Missouri College of Agriculture, Agricultural Experiment Station Research Bulletin No. 27*, pp. 1-44. Columbia, Missouri, December 1916.

CATTLE

For many years research work has been carried out at the Missouri Agricultural Experiment Station on the influence of various foodstuffs on the composition of milk and butter. Recently, a new series of experiments has been started on cottonseed products, in order to explain, if possible, the varied and inconsistent results obtained on this subject by other investigators. These experiments have shown that the roughage which forms the base of the ration is the real factor in the effect of cottonseed products on the composition and properties of butter. The amount of cottonseed products fed, particularly the quantity of cottonseed oil they contain, is also important.

Concerning the character of the roughage, the data obtained show convincingly that with certain roughages, such as timothy hay and corn stover, (dried maize stems with cobs removed), timothy hay alone, alfalfa hay alone or cottonseed hulls, very marked effects on the composition and properties of butter accompany the feeding of cottonseed products, in some cases even in moderate amount. On the other hand, certain roughages, particularly corn silage, so counteract the effects of cottonseed products that moderate quantities, e. g. 3 or 4 lbs. of meal, in some cases even as much as 6 lbs., may be fed daily without lowering the quality of the butter or changing appreciably the composition of the fat.

This paper includes: — 1) an historical part, with a chronological bibliography on the subject studied and 4 tables of numerical data; 2) an experimental part illustrated by 12 tables of analytical data.

The results obtained led to the following conclusions:

1) The feeding of cottonseed produces characteristic effects upon the physical and chemical constants of butter fat and upon the properties of butter. These are manifested, in general, by a decrease in the saponification value and Reichert-Meissl number, and an increase in the iodine absorption value and the melting point of the butter fat. The effects on the butter are to cause a firmer body, frequently a gunmy consistency, a higher standing up quality or ability to withstand a higher temperature without losing its body, a flat, oily taste, and a better keeping quality.

2) The effects of feeding cottonseed products in the directions indicated are due largely if not entirely, to the amount of cottonseed oil which they contain.

3) The extent of these effects is largely modified by the character of the raw foodstuffs which form the base of the ration. The effects are

more marked when cottonseed products are fed with dry roughage, but less so if a fairly large amount of corn silage is given, as, in this case, the effects are sometimes neutralised. Further experiments are in progress to determine whether other roughages have similar properties.

4) Small amounts of cottonseed products may be fed to cows on fresh pasture with very beneficial effects upon the body and keeping qualities of the butter.

5) The effects of feeding cottonseed meal upon certain of the constants of the butter fat, particularly the Reichert-Meissl number and iodine value, may be somewhat modified by continuous feeding. The effects on the melting point of the fat and the other properties of the butter continue, however, as long as the cottonseed meal is fed.

6) The feeding of large quantities of cottonseed meal and whole cottonseed as still practised in many localities in the South must be considerably modified if the butter industry of that part of the country is to attain its proper place in the butter industry of the nation. The use of the whole seed as a feed for dairy cattle is to be strongly discouraged on account of its excessive oil content.

PIGS

652 - Pig Feeding Experiments on the Model Farm of Dikopshof, Germany. — RICHARDSEN, A., in *Landwirtschaftliche Jahrbücher*, Vol. 49, Pt. 3-4. Berlin, 1916.

#### I. — THE FEEDING OF YOUNG PIGS.

Fifteen experiments were carried out to determine the nutritive value of "cerealis", a new food prepared by a factory at Andermach (Rhine) and recommended as a substitute for whole milk (fat) in breeding pigs. Experiments showed it to be a malt meal of the following composition (average of 6 samples).

Water . . . . .	8.96 %	
Crude protein . . . . .	12.56	(pure albumin 11.07 %)
Crude fat . . . . .	2.68	
Nitrogen-free extract . . . . .	68.28	(maltose 27.17 %; starch 27.59 %)
Crude fibre . . . . .	3.79	
Ash . . . . .	2.98	

The food differs from ordinary malt in that its starch contains more sugar.

The pigs of each group were of similar size and constitution. During the whole of the experiment (i. e. from the 31st. to the 120th. day of their lives) each pig was given in each ration, which was fed as a warm wash, the total amount of food as shown in the table:

	Ration A	Ration B	Ration C	Ration D
Whole milk . . . . .	20 litres	—	10 litres	10 litres
Skim milk . . . . .	190 litres	40 litres	60 litres	60 litres
"Cerealis" . . . . .	—	10.8 kg. *	16.2 kg. **	8 kg. ***
Ground barley . . . . .	51 kg.	51 kg.	76.5 kg.	64.5 kg.
Meat meal . . . . .	1.5 kg.	1.5 kg.	6.25 kg.	6.25 kg.

\* 180 portions of 60 grams.

\*\* 270 portions of 60 grams.

\*\*\* 160 portions of 50 grams.



As the price of "cerealis" increased continuously, it was later replaced by two other food stuffs called "R<sub>1</sub>" and "R<sub>2</sub>". The first is composed of:—Barley meal, 50 %; "Futterzucker" (Fodder sugar) 45 %; Lime, 5 %; and the second of: Fodder sugar 90 %; Lime, 10 %.

The results of the experiments are summarised in the appended table.

*Conclusions*: — 1) Malt meal may well replace milk partially and physiologically in rearing young pigs. In all the experiments the animals had good appetites and thrived well. It has not yet been determined whether or not this good effect is due to the maltose.

2) It is neither possible nor desirable to replace milk completely by "cerealis".

3) The partial substitution of "cerealis" for milk is specially marked when the growth of the pigs left a little to be desired and the new food was observed to increase their growth.

## II. — PIG FATTENING.

Numerous very accurate experiments were made on the fattening value of various foods to determine how far one may be replaced by another. The animals received a basal ration to which was added the food to be tested; it was made up according to Kellner's values and changed every 3 weeks in proportion to the live weight of the pigs. In addition each animal received per day: 6 gr. of salt and 6 gr. of lime. Each experiment included 2 or more periods. The pigs were usually weighed once a week.

*Dried yeast compared with meat meal.* — 98 day experiment with 6 pigs divided into equal groups. — *Basal ration*: — Ground barley + rolled potato. To group A up to 3 kg. of meat meal per 1000 kg. of live weight were given per head, and to group B. up to 6 kg. of dried yeast. In order to ensure assimilation of the yeast the animals of group B also received 1 kg. of cottonseed.

Group A (meat meal) showed an increase in live weight of 633 gr. per day, and group B (yeast), 587 gr. The quality of the meat was about the same in the two groups. It seems clear that dried yeast may easily replace meat in pig-fattening.

*"Körnerblutfutter" compared with meat meal.* — The first food, prepared by FATTINGER and Co., Berlin, and put on the market in the form of grains is, according to HANSFEN, a mixture of ox-blood (10 %) and wheat meal (90 %) (1).

With 4 pigs, divided into 2 groups in each case, 4 experiments were made lasting 139, 105, 97 and 90 days respectively. The following *basal ration* was fed

1st. experiment. — Rolled potatoes + barley.

2nd. experiment. — Potatoes + barley + fish meal.

3rd. experiment. — Crushed potatoes (2) + barley + fish meal.

4th. experiment. — Barley + rolled potatoes + fish meal.

Group I received up to 2 kg. of meat meal and group II up to 9 kg of "Körnerblutfutter" per 1000 kg. of live weight each day.

Taking the average of the 4 experiments, the daily increase in live weight was 631 gr. for group I (meat meal) and 645 gr. for group II (Körnerblutfutter); 100 kg. of starch value had produced respectively 32.8 kg. and 32.8 kg. of live weight. The "Körnerblutfutter" thus gave as good, or even better, results than meat meal, but it is inadvisable to feed more than 7.5 kg. per day per 1000 kg. of live weight of this food. It is best to mix it with fish meal in the ration of 1 part meal to 3 to 5 parts "Körnerblutfutter". No special effect can be attributed to this last food.

*Crushed potatoes compared with rolled potatoes.* — Four experiments lasting 118, 77, 84 and 83 days respectively were made with 28 pigs. *Basal ration*: — Crushed barley + meat

(1) See also B. 1913, No 715.

(Ed.).

(2) Crushed potatoes (Presskartoffel) are obtained by crushing the raw potatoes to remove part of the moisture, then drying the residue.



## Results of 15 experiments.

Experiment		Number of animals	Rations	Daily increase per head	Cost price of 1 kg increase in live weight
No.	Group				
I	A	2	A	390 g	0.572 Mark (1)
	B	4	B	277	0.578
II		3	A	383	0.573
III		6	C	448	0.533
IV		6	C	484	0.559
V		6	C	468	0.519
VI		6	C	442	0.544
VII	A	4	C	511	0.529
	B	4	C without "cerealis"	456	0.434
VIII	A	3	C	471	0.574
	B	3	C without "cerealis"	441	0.448
IX		10	D	372	0.604
X		7	D	370	0.608
XI		7	D	562	0.621
XII	A	3	D	420	0.500
	B	3	D with R <sub>1</sub> instead of "cerealis"	420	0.423
XIII	A	3	D	386	0.561
	B	3	D with R <sub>1</sub> instead of "cerealis"	394	0.473
XIV	A	3	D	333	0.648
	B	3	D with R <sub>2</sub> instead of "cerealis"	330	0.505
XV	A	3	D	367	0.591
	B	3	D with R <sub>2</sub> instead of "cerealis"	357	5.524

(1) 1 mark = 1/— at par.

meal in 3 experiments; Meat meal + fish meal in 1 experiment. Up to 20 kg. of rolled potato and 18 kg. of crushed potato per 1000 kg. of live weight were given each day.

The daily increase in live weight was: — 668 gr. with the rolled potatoes and 671 gr. with the crushed potatoes; 100 kg. of starch value of the foods gave respectively 34.6 kg. and 34.2 kg. of live weight. Apart from the formation of bone, the two foods gave the same result; one may, therefore, replace the other if the remainder of the ration is of normal composition. The flesh formed by these two foods was not inferior in quality to that formed by barley.

*Sliced potatoes compared with Roumanian barley.* — 2 experiments, each of 63 days' duration, with 10 pigs. — *Basal ration:* — Group I: — "Maizena" (1) + fish meal; Group II: — "Maizena" + fish meal + blood meal. 27 kg. of barley and 24 kg. of sliced potatoes were given daily per 1000 kg. of live weight.

The barley increased the live weight by 597 gr. per day; the sliced potatoes increased it by 613 gr.; 100 kg. of starch value of the food produced 34.4 kg. and 35.2 kg. of live weight respectively. There is not a great difference between the foodstuffs, nevertheless the potatoes gave rather more satisfactory results.

*Sorghum compared with barley:* Sorghum (*Andropogon Sorghum*) grain from German East Africa was compared with barley in 2 experiments lasting 118 and 97 days respectively.

Twelve pigs were used. — *Basal ration:* 1st experiment: — Sliced potatoes + meat meal

(1) "Maizena" is a food containing maize much used in Germany.

+ fish meal. 2nd experiment. — sliced potatoes + ground soya beans. Up to 20 kg. of barley and 20 kg. of sorghum per 1000 kg. of live weight were fed daily.

The average daily increase in live weight per day was 597 gr. with barley and 623 gr. with sorghum; 100 kg. of starch value of the foods gave 36.7 kg. and 37.7 kg. of live weight respectively. As sorghum gave rather better results it may replace barley, but it is inadvisable to feed it in larger quantities than half that of the starch value contained in the ration.

653 — **Temperature Experiments in Incubation.** — PHILIPS, A. G., in *Purdue Agricultural Experiment Station Bulletin* No. 195, Vol. XIX, December 1916.

POULTRY

This experiment was planned with the idea of finding out the influence of different temperatures in the incubator on brown and white eggs, with the hope of finding the upper and lower temperature limits, influence on temperature readings from placing thermometers at different heights in the machine, and several minor points.

Four incubators were employed and kept at the following temperatures:

100° F. — 101° F. — 102° F. — 103° F.; during each of the two following weeks the temperature was raised 1° F. In each incubator were placed 75 white eggs (white Leghorn) and 57 brown eggs (Plymouth Rock).

Four experiments were made, at the following dates:

Experiment	No. 1	: from	April	18	to	May	9,	1913
»	No. 2	»	»	14	»	»	5,	1915
»	No. 3	»	March	2	»	March	23,	1916
»	No. 4	»	April	12	»	May	3,	1916

The thermometers used, five in number, were standard incubator thermometers, generally known as hanging, standing, touching, and Inovo. The hanging thermometer was suspended from the top of the incubator, two inches above the centre of the egg tray. The standing thermometer was on a metal stand in the centre, towards the front of the machine, the bulb on a level with the top of the eggs but not touching them. The touching thermometers were two in number, one on brown and one on white eggs, near the standing thermometer. The bulbs of these were on a level with the top of the eggs and touching them. The Inovo is a long bulbed thermometer in a celluloid egg, supported by a stand, and is supposed to register the temperature of the germ in an egg. It was placed near the other thermometers. These were close together, so that any variation in temperature due to position in the machine, would be reduced to a minimum. All thermometers were tested and checked before each experiment.

The details of the observations are given in a set of 21 tables. The conclusions drawn are as follows:

1. A temperature of 101-102-103 degrees the first, second and third weeks respectively, using a standing thermometer on a level with the top of the eggs but not touching them, will prove very satisfactory in the artificial hatching of hens' eggs.

2. A temperature slightly above or below 101-102-103 degrees will not influence the hatch one way or another.



3. A temperature of 103-104-105 degrees is too high and will injure the hatch greatly.

4. A temperature of 102-103-104 degrees is a little high for successful incubation.

5. There seems to be little difference in number of chicks hatched between machines run at 100-101-102 degrees and machines run at 101-102-103 degrees. This means that at such low temperatures a variation of one degree or more will have little influence.

6. Operators of incubators should endeavour to hold down temperatures below common practice, rather than allow them to rise above it.

7. Brown and white eggs need the same temperature.

8. Brown eggs are no warmer or cooler than white eggs.\*

9. Brown eggs have a tendency to produce poorer fertility, more dead germs, more chicks dead in shell and fewer chicks than white eggs. No reason from the standpoint of incubation can be given for this peculiarity.

10. Under ordinary conditions, it is reasonable to expect white eggs to be 90 to 92 per cent. fertile and hatch 75 per cent. of the fertile eggs. Brown eggs will run 2 per cent. less in fertility and 12 per cent. to 15 per cent. less in hatchable fertile eggs.

11. Touching thermometers average slightly higher temperatures than standing thermometers. Such differences have no influence on the hatch.

12. As the chicks develop in the eggs, they give off heat tending to equalize the temperature in all parts of the machine. This is demonstrated by the hanging thermometer. This thermometer runs at a uniform temperature for the three weeks, but the temperature at the level with the eggs starts about 2.5 degrees lower and rises until it comes within one degree of the hanging thermometer temperature on the twenty-first day.

13. A temperature with a standing thermometer of 100.5 degrees the first week, 101.5 degrees the second and 102.5 degrees the third week compares well in temperature and hatching results with a hanging thermometer temperature of 103 degrees for three weeks.

14. There does not seem to be any hard and fast recommendation that can be given for the proper temperature of an Inovo thermometer.

654 - **Spore-Forming Bacteria of the Apiary.** — MC. CRAY, ARTHUR H. (*Apicultural Assistant, Bureau of Entomology, United States Dept. of Agriculture*) in *Journal of Agricultural Research*, Vol. VIII, No. 11, pp. 399-420, figs 6, Plates II. Washington, D. C., March 12, 1917.

Lambotte (1) in 1902, claimed to have produced "foul brood" of bees by feeding them cultures of *M. mesentericus vulgatus* and stated in explanation that *B. alvei* arises as a special variety of *M. mesentericus vulgatus* when the cultures are grown upon media prepared from the juices of bee larvae. This comparison of the two organisms disagreed so materially

(1) LAMBOTTE, U. 1902. Recherches sur le microbe de la "loque", maladie des abeilles. In *Ann. Inst. Pasteur*, t. 16, No. 9, pp. 694-704. Paris, 1902.



with the observations of the present writer that in 1911 he began a series of feeding experiments with *B. mesentericus vulgatus*. At the outset, however, it was observed that of the organisms of the *B. vulgatus* group isolated from the specimens of bee comb and brood for examination it was not possible to identify all as one species. The first task was therefore the identification of the various organisms of this group and a comparison of them with the other known spore-forming bacteria of the apiary: *B. alvei*, *B. larvae* and *B. orpheus*. The present paper gives the detailed observations of the writer on *B. vulgatus*, *B. mesentericus* and *B. orpheus* with an account of inoculation experiments carried out with the object of checking LAMBOTTE's claims. The results of these latter were negative throughout. The writer summarises his conclusions as follows:

There are at least 5 spore-forming bacteria of the apiary — *B. vulgatus*, *B. mesentericus*, *B. orpheus*, *B. alvei* and *B. larvae*. Mistakes in the identification of the above-mentioned organisms might well be made, especially without knowledge of their occurrence. There seems no doubt that many of the earlier investigators of bee diseases confused the identity of the spore-forming bacteria of the apiary but from our present knowledge of these organisms, their identification should be a matter of less difficulty.

The author, from his study of *B. vulgatus*, *B. mesentericus* and *B. alvei*, believes that the biological differences of the 3 species are too great to warrant expecting the transformation of one to another in any short period of time.

Even if it is granted that LAMBOTTE fed pure cultures of *B. alvei*, his results would not agree with those of present day investigators of bee diseases, since *B. alvei* has not been found to produce disease in bees upon repeated inoculations.

655 — Partial Sterilisation of Mulberry Leaves in Feeding Silk Worms. — SACCHI, ROSA, in *Le Stazioni Sperimentali Agrarie Italiane*, Vol. 4, Part 2, pp. 69-72. Modena, 1917.

SERICULTURE

The sterilisation of mulberry leaves as a prevention against "flacherie" has been attempted many times with varying results. The author has, therefore, undertaken experiments to determine whether partial sterilisation either protects the worms from attacks of the disease or increases the vigour of vegetative growth.

The experiments were carried out at the Agricultural Institute of Perugia in the spring of 1916, selected yellow Ascoli silk worms being used by preference. The silk worms were divided into 8 groups of 250 each, and subjected respectively to the following treatments:

- 1) Control group fed with ordinary leaves.
- 2) Fed with leaves washed in fresh water.
- 3) Fed with leaves washed in boiled water.
- 4) Fed with leaves washed in a lysoform solution prepared with fresh water.
- 5) Fed with leaves washed in a lysoform solution prepared with boiled water.
- 6) Fed with leaves washed in a "tachiol" (silver fluoride) solution prepared with fresh water.
- 7) Fed with leaves washed in a "tachiol" solution prepared with boiled water.

## 8) Control.

The solutions were made up in the following strengths :

"Tachiol" : during the 2nd. stage, 1 : 200 000 ; during the 3rd. stage, 1 : 150 000 ; during the 4th and 5th. stages, 1 : 100 000 ;

Lysoform : 2nd. stage, 2  $\frac{0}{100}$  ; 3rd. stage, 3  $\frac{0}{100}$  ; 4th. and 5th. stages, 5  $\frac{0}{100}$ .

The results obtained led to the following conclusions :

1) If the silk worms are fed on leaves washed with water or an aqueous solution of lysoform or "tachiol", far fewer leaves are consumed than if they had not been subjected to the treatment described.

2) Although silk worms fed on moist leaves eat less they weigh more than those fed on dry leaves.

3) The treatments described did not prevent the occurrence of a few sporadic cases of "flacherie" and emaciation.

4) The silk cover of cocoons from silk worms fed on partially sterilised leaves is heavier than that from silk worms fed on ordinary leaves. This increase in weight also occurs when the silk worms are fed on leaves sufficiently well washed with fresh or boiled spring water.

5) The feeding of silk worms with washed leaves has a favourable influence on the quality of the silk, particularly on the length, tenacity, and elasticity, as well as the weight of the reeled silk.

## FARM ENGINEERING.

656 - **The Encouragement of Mechanical Cultivation in Italy and France.** — I. *Bollettino dei Ministeri per l'Agricoltura, per l'Industria, il Commercio ed il Lavoro*, Year 16, Vol. I, Parts 7 and 8, pp. 300-302. Rome, April 1 and 16, 1917. — II. *Feuille d'Informations du Ministère de l'Agriculture*, Year 22, No. 19, pp. 6-7. Paris, May 8, 1917.

ITALY : By decree of February 18, 1917, the Minister for Agriculture has issued the following order :

Subsidies to be granted to agricultural societies and syndicates for the purchase of tractors for immediate use on the land may amount to 30 % of the cost price of the machines, including ploughs and accessories.

Those organisations that buy at least 5 tractors for general use within the limits of a province, may receive a supplementary premium of 10 % of the cost price.

Subsidies to private agriculturists for the purchase of tractors for immediate use, may amount to not more than 20 % of the sale price, including ploughs and accessories.

Requests for subsidies should be directed to the provincial Commissions, and should include, besides technical details of the tractors and the price, the undertaking to buy the tractor within a limited time. The provincial Commissions will transmit the requests, together with the reasons for their approval, to the Ministry for Agriculture.

II. — FRANCE. — The Ministry for Agriculture has published the subsidies granted, in 1916, to the various syndicates, societies, communes and departments which are interested in mechanical cultivation, so as to enable them to purchase agricultural tractors and motors. The subsidies, ranging from 2 125 to 79 790 francs, make a total of 206 711 francs. The three national Schools of Agriculture have received, for the same purpose, subsidies amounting to 19 747 francs.

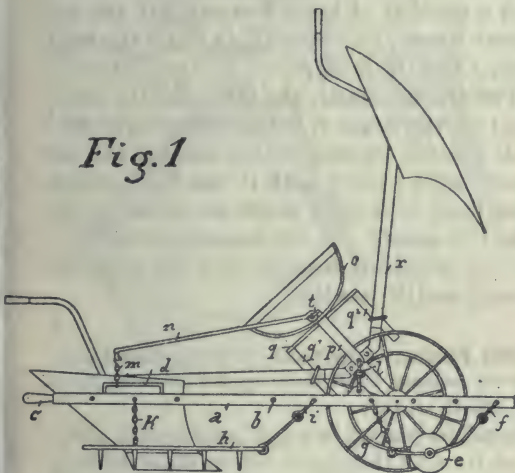


657 - The Donalies Patent Mechanism for Attaching One on More Implements to a Balance-Plough. — *Deutsche Landwirtschaftliche Presse*, Year 44, No. 27, p. 246, 5 fig. Berlin, April 4, 1917.

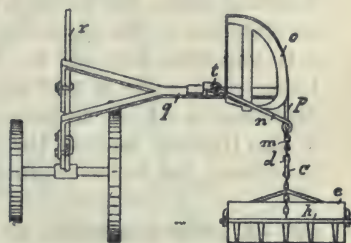
This new mechanism, invented by OTTO DONALIES of Cologne (German patent No. 296 491) is characterised by the fact that it enables one or more implements (harrow, roller, etc.) to be attached to a balance-plough, the implements turning simultaneously with the plough.

*The DONALIES Mechanism for attaching one or more implements to a balance-plough.*

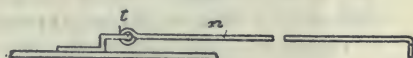
*Fig. 1*



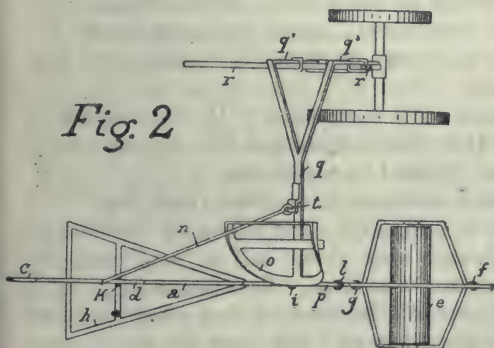
*Fig. 3*



*Fig. 4*



*Fig. 2*



*Fig. 5*

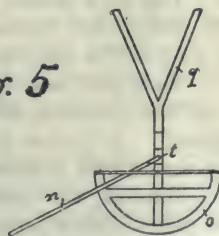


Fig. 1: Balance-plough with the mechanism in side-view.

Fig. 2: The same in plan.

Fig. 3: The same from the front.

Fig. 4: Jointed bar *n*, for moving the bar *a* so as to make a half-turn.

Fig. 5: The arched slide-bar *o* with the bar *n*, jointed at *t* with the support *q*:

horizontal view.



The mechanism is shown with a balance-plough: in side-view in fig. 1; in plan in fig. 2, in front-view in fig. 3; while fig. 4 shows the side view of the bar for turning the mechanism, and which is seen from above in fig. 5, with a portion of the turning mechanism.

A support  $q$  is fixed on the beam  $r$  by the feet  $q^1$  and  $q^2$ , its front end being curved downwards and having an arched slide-bar  $o$  and a bar  $n$  mounted on it. The latter, jointed at its end  $t$  with the support, engages towards that end with the slidebar, along which it can run from one end to the other. To the front of the bar  $n$  hangs a chain  $m$ , and in front of the end  $p$  of the support  $q$  is attached a swivel hook  $l$  serving, like the chain, to support a bar  $a$  perforated with a number of holes  $b$  to support the implements, such as the harrow  $h$ , fixed by means of the chain  $k$  and the hook  $i$ , and the roller  $e$ , held by the chain  $g$  and the hook  $f$ .

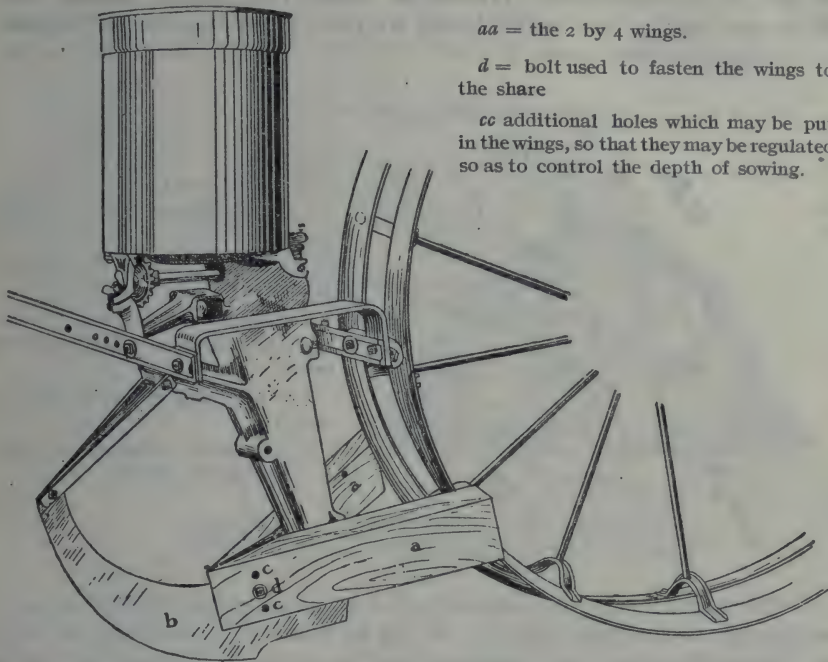
When the plough has arrived at the headland, the other mould-board is swung down, the support  $q$  (fixed to the beam  $r$ ) being swung over with its slide bar at the same time; this forms a tipping action causing the bar  $n$  to slip from one end to the other and to carry with it the bar  $a$  which turns at an angle of  $180^\circ$  round the hook  $l$ , to right or left according to the direction in which the mould board is swung, the implements attached to it also turning. So that the latter can be guided straight after the automatic turning the bar  $a$  is provided with a stilt handle  $c$ .

658 - **A Lister Attachment for a Cotton Planter.** — HASTINGS, S. H., in *United States Department of Agriculture, Bureau of Plant Industry, Crop Physiology and Breeding Investigations*, 3 pp., 1 fig. Washington D. C., March 27, 1917.

In sowing cotton, the seed should be placed in a soil sufficiently moist and at such a depth that it can push its way through to the surface without difficulty. Where cotton is grown under irrigation, the soil is often allowed to become too dry before the seed is put in, and there is always danger that rain will cause a crust to form over the surface. Again, if planted too deeply the tender seed leaves cannot push their way up through a compacted soil, especially if the seed is planted deep.

The seed should not be covered with more than  $1\frac{1}{2}$  to 2 inches of soil, but in dry regions it is rare that the surface soil will remain moist at that depth long enough to allow the seed to germinate.

To avoid these troubles and also to break the surface crust, the writer describes a simple device that can be adopted to any sower by the farmer himself. A hole is drilled through each shoe about half an inch from the top and about 7 inches from the rear of the shoe. Two pieces of 2 by 4 inch lumber, 17 inches long, with one side beveled so that when the two are placed one on either side of the shoe they will just clear the wheel, complete the attachment. With this device there is no danger that the seed will be covered too deeply; besides the seed is planted at a very uniform depth, no matter how the condition of the surface soil may vary.



*aa* = the 2 by 4 wings.

*d* = bolt used to fasten the wings to the share

*cc* additional holes which may be put in the wings, so that they may be regulated so as to control the depth of sowing.

Planter attachment used to push away the dry surface soil.

659 - **New Stump Burner for Logged-Off Lands.** — L<sup>c</sup> ROY W. ALLISON, in *Engineering Record*, Vol. 75, No. 13, pp. 495-496, 1 fig. New York, March 31, 1917.

The writer has previously described the ROSS stump burner (1). He now describes the HUBBARD stump burner, which operates more slowly through the use of natural draught, while the operating cost is reduced to a minimum.

The burner consists of an adjustable steel hood of two principal sections to form a base and top, designed to be placed over the stump.

By means of draught tubes, placed around and near the base of the burner, the need for any blower or other artificial draught device is eliminated.

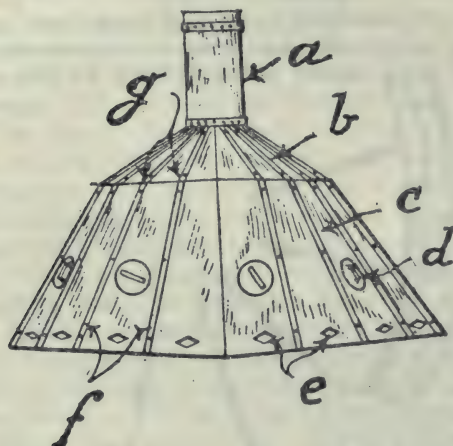
The lower section panels are made from steel sheets and are 11 in. wide at the top, 19 in. at the base and about 48 in. high. On one edge of each panel a  $\frac{1}{2}$  in. lip is bent at an angle slightly in excess of  $90^\circ$ , while the other edge is made in the form of an inverted U,  $\frac{1}{4}$  in. wide and  $\frac{1}{2}$  in. deep. Bolt holes are punched near the bottom, middle, and top of its joint for the field connections. A 2-in. hole is provided in the centre of each of the lower panels near the base for the insertion of the draught tubes made of

(1) See *B.* 1915, No. 937 and *B.* 1916, No. 1007.

(Ed.).



$\frac{1}{2}$  in. iron pipe. A damper, pivoted on a single rivet, covers the hole when the draught tube is not used. Every alternate panel has also an 8 in. hole for observation purposes.



- a* = Smokestack
- b* = Upper panels of No. 22 gauge steel.
- c* = Lower panels of No. 18 gauge steel.
- d* = Observation holes.
- e* = Draught tube holes with damper.
- f* = Lips and n-shaped edges of panels.
- g* = V-shape tie bolts for fastening upper to lower panels.

The upper section is composed of sheet steel panels, similar in shape and design to the lower panels. A  $1\frac{1}{2}$  in. overlap is provided to allow for joining the upper and lower sections by means of V-shaped tie bolts.

The smokestack, of sheet metal, is adjustable, and is supported by a metal band at the base and top of the cylinder. The size of the smokestack varies according to the number of panels used to make up the burner. A 12 in. stack has been found in practice the best size to use with a sixteen-panel hood.

In erection the lower panels are bolted together in groups of 2 or 3, to facilitate handling and moving. The different groups are then placed round the stump and the remaining connections made with heavy cotter pins. The roof section is bolted together and the stack is attached before being fastened to the bottom panels. Before operating, dirt, etc., is cleared away sufficiently to allow kindling of a good fire. The fire is started through the observation openings and the draught pipes are inserted so as to give the best draught. The draught increases as the temperature rises under the hood, being augmented by feeding logs to the fire as needed after kindling.

This burner will consume stumps of from 3 to 5 ft. in diameter in 24 hours, while 6 to 7 ft. stumps require 30 or 40 hours.

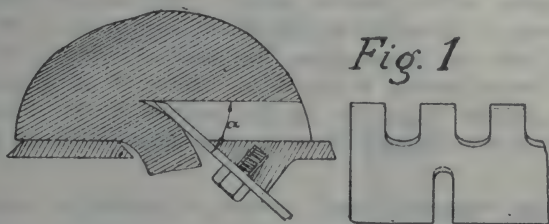
660—The "Jahn" Curved Knife for Root-Pulping Machines.—*Deutsche Landwirtschaftliche Presse*, Year 44, No. 28, pp. 254-255, 3 figs. Berlin, April 7, 1917.

The flat, toothed knives ordinarily used in machines for cutting man-gold and other forage roots into slices have to be placed obliquely to the cutting plane so that they tear rather than cut, thus wasting much energy as well as valuable juice from the roots.



These disadvantages may be avoided by using knives whose rounded teeth ("getollte Messer") are in the cutting plane. Machines having such knives work well and easily and cause less loss of juice: but they have

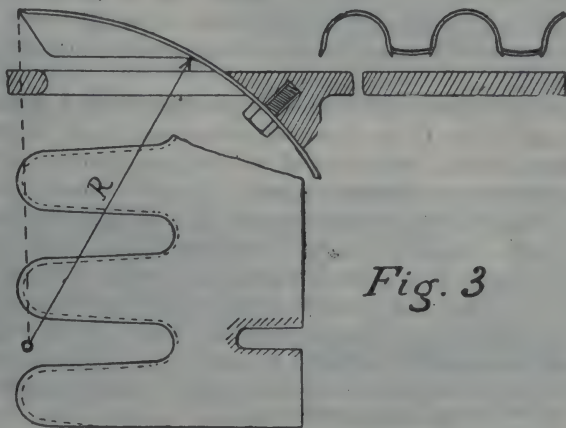
*Knives for root pulping machines.*



*Fig. 1*



*Fig. 2*



*Fig. 3*

Fig. 1 : Ordinary flat-toothed knife.

Fig. 2 : Round-toothed knife.

Fig. 3 : The new curved, toothed knife of GEORGE JAHN.

always the disadvantage that once in place they cannot be regulated, and as they wear, their work gradually deteriorates.

The knife invented by GEORGE JAHN of Liegnitz (German patent No.

297 219), combines the advantages of the easily-regulated, flat-toothed knife with those of the round-toothed knife (easier to work and less loss of valuable juice), without having the disadvantages inherent to each of the types. Accordingly, the blade is curved in an arc of a circle in the direction of cutting, as is the back which connects it with the concave projection of the knife holder with a similar curve. This curve is such that the cut is perpendicular to its radius so that the cutting angle =  $0^{\circ}$ . On the other hand, as the knife can be moved on the concave bed, it can be adjusted as it wears, by always turning it round the centre of the curvature (that is, round the interior extremity of the radius of the curve), so that the cutting angle is not changed by wear of the edge (as shown in fig. 3).

661 - **The Schilde "Universal Drier"** — PAROW, in *Zeitschrift für Spiritusindustrie*, Year 40, No. 2, p. 13, 9 fig. Berlin, January 11, 1917.

The BENNO SCHILDE machine shops at Hersfeld (Germany) manufacture a drier adapted specially to fruit and vegetables, but also suited for drying other moisture-containing products and for cereals, whence its name of "universal drier" ("Universaltrockner"). The advantages of this drier are as follows: small bulk, easy to set up, requires little attention (1 man and a couple of women suffice to run it), relatively high yield and is equal to the demands of high-class trade. The city of Berlin possesses 2 machines of this type among its vegetable drying plant and will shortly instal a third.

At the request of the firm of SCHILDE, the writer has submitted this drier to careful tests; although not yet quite completed they already show that the apparatus is a valuable acquisition to the trade in dried agricultural produce.

The SCHILDE "Universaltrockner" (of which Plate I shows the external appearance and Plate II the internal arrangement and working) is a tray drier (Hordentrockner), composed of an iron cage flanked by an automatic hoist and containing a chamber in which the air is heated by means of a heating set *g* (Plate II, fig. 1) adjoining another drying chamber ("Trockenschacht") which contains 10 racks ("Horden") 6 sq. metres in size, forming 2 compartments of 5 racks separated by a second heating set *h*. A ventilator *B*, placed at the top of the cage, draws up the air of the room in which the drier is placed, and then passes it through the aperture *A* into the heating chamber where after being warmed to a temperature of 60 to 70° C. it passes over the trays from top to bottom, is heated anew over another heating set *h* ("Nachheizbatterie"), rises at a temperature of 85 to 95° C. and passes through the 5 loaded trays of the upper compartment, eventually reaching, cooled to about 32° C. and saturated with water vapour, the discharge pipe *c*.

The trays, being moveable, allow the matter to be dried to be moved downwards *from top to bottom* while the hot air is passing through in the opposite direction: *from below upwards*. To do this the fresh produce is led, by means of the automatic hoist at the side, right to the top of the drying chamber, whence it descends, gradually losing moisture, first to the bottom

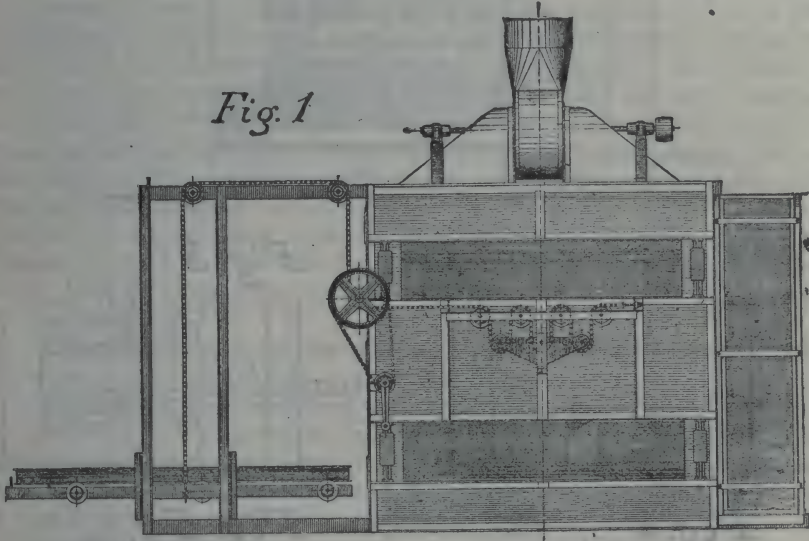
of the upper compartment and then, passing the second battery *b* in the lower compartment continues in the same direction meanwhile losing its remaining moisture, and eventually reaches the bottom where the finished dry product is discharged.

The various steps of the above process, illustrated by the 7 figures of

SCHILDE "*Universal Drier*".

PLATE I — *Exterior view.*

*Fig. 1*



*Fig. 2*

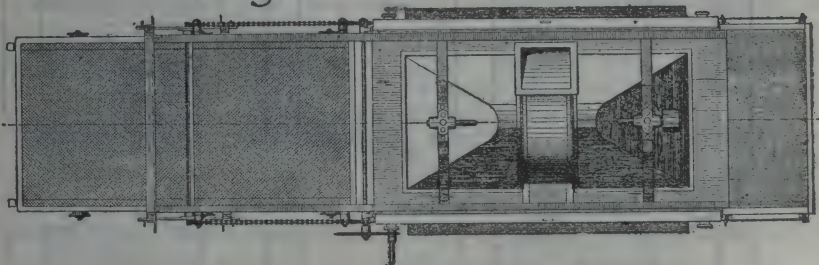


Fig. 1: Side view.

Fig. 2: From above.

Plate II, are as follows : 120 to 130 kg. of the fresh produce are spread evenly upon the hoist (fig. 2), a lever is pulled and the hoist rises automatically (fig. 3) to the top of the drying chamber where the produce is slid off the lift over rollers and introduced through the open door *d* (figs. 1 and 4). This



SCHILDE "Universal Drier"  
 PLATE II. — Internal arrangement and working.

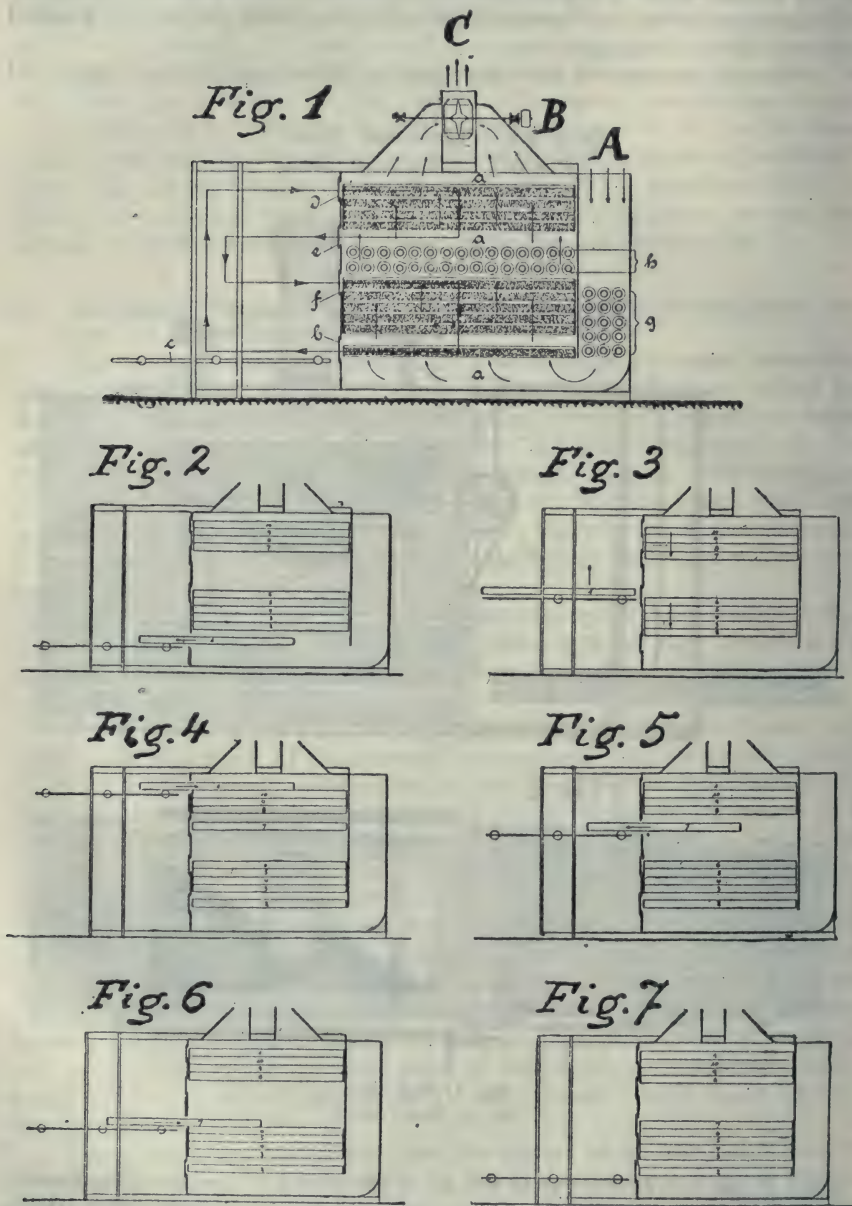


Fig. 1 : Longitudinal section.

→ Direction of air currents.

→ Path travelled by hoist.

Figs. 2-7 : Schematic longitudinal section showing stages in working of hoist.

door is then closed and the ventilator *C* set in motion which draws up the hot, dry air through the whole of the drying chamber. Subsequently, another lever allows the empty hoist to descend, pick up another tray at the bottom full of fresh produce, and convey it to the top. This operation is repeated until the upper compartment (which is warmer) contains 5 trays full of material to be dried.

When this is completed, the hoist is no longer sent down to the bottom but only as far as the level of the door *e*, corresponding to the lowest tray of the top compartment (figs. 1 and 5). This tray, which was introduced first and contains matter which has already undergone the first drying, is then withdrawn through the door *e* onto the hoist which descends to the level of the door *f* at the top of the lower compartment (fig. 1). The produce on the tray is then turned and the latter allowed to enter the lower compartment, beneath the second battery (figs. 1 and 6) to complete the drying. This done, another pull at the lever allows the empty hoist to descend, pick up a full tray and rise to the top where it replaces, in the upper compartment, the tray just extracted. The hoist then drops to the end of the door *e*, picks up the lowest tray of the upper lot and descends to the level of the door *f* through which it enters the lower compartment. The hoist then drops to the bottom, again picks up a full tray and rises to the top of the upper compartment.

These operations are repeated in the same order until the drying chamber contains all 10 trays full of produce in course of drying.

When this lot of operations is accomplished, the hoist, when it has reached the bottom, no longer picks up a fresh tray full of fresh produce (which would be the 11th), but takes the lowest tray of the bottom compartment (viz: the first introduced into the apparatus, see fig. 7). The dry product is then removed from the tray, spread with fresh stuff and the cycle of operations begins anew.

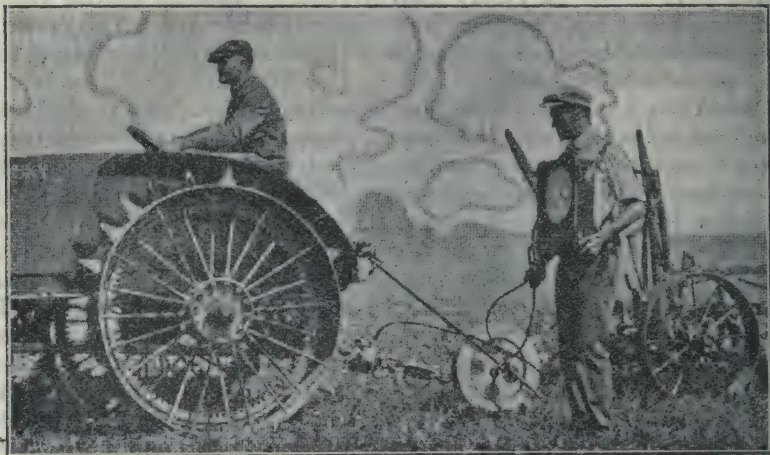
As the apparatus receives a fresh tray of produce every 20 minutes till all 10 trays have been used, the complete drying process occupies 200 minutes, i. e. 3 hours and 20 minutes. The work capacity of the plant may be estimated as follows: supposing it to be fed fresh slices of swede at the rate of 21 kg. per sq. metre of tray it could dry 9000 kg. of these slices in 24 hours, equivalent to 12 000 kg. of swedes.

During the tests, slices of peeled roots were dried both raw and having undergone previous soaking. In both cases a dry product was obtained of good appearance and flavour and containing about 13.5 % of moisture. The product obtained from roots soaked in hot water was distinguished by a particularly good aroma.

662 - **The Hyatt Dynamometer.** — *The Canadian Thresherman and Farmer*, Vol. XXII, No. 2, p. 20, 1 fig. Winnipeg, February 1917.

This tractor dynamometer, built by the HYATT ROLLER BEARING COMPANY, Chicago, Illinois, has been used in a great many tractor trials to assist in the development of better machines. It consists chiefly of a hydrostatic pressure unit coupled between the tractor and the plough and a record-

ing gauge which automatically records the draw-bar pull by means of a needle moving over a chart.



HYATT Dynamometer.

663 - **Portable Water Heater.** — COVELL, EARD D. in *Engineering Record*. Vol. 75, No. 13, pp. 520, fig. New York, March 31, 1917.

A portable water heater used very successfully by the writer in build-



Portable water heater.



ing small concrete structures for irrigation canals is shown in the sketch. As the structures averaged between 6 and 10 cu. yds. of concrete each, it was necessary to have some means of heating the water that could be moved easily and quickly.

The heater built consists of a common sheet-iron heating stove inside which was fitted a coil of 1 inch, black iron pipe with three turns, the ends of which were fastened into the sides of the water barrel with lock nuts. The stove and barrel were wired securely to a stone boat. When the concrete mixer was moved about, the heater was easily pulled along behind.

## 664 - Review of Patents.

### *Tillage Machines and Implements*

- |                |  |
|----------------|--|
| Austria        | 73 469. Tractor plough with the plough body frame fixed, and adjustable in height by means of a hand screw.  |
| France         | 482 944. Motor-tractor for vineyard cultivation.<br>482 980. Animal-drawn motor cultivator.  |
| United Kingdom | 104 906. Cultivating implements.   |
| United States  | 1 216 836. — 1 221 783 — 1 222 364 — 1 222 884 — 1 222 898 Ploughs.<br>1 216 568. — 1 216 810 — 1 223 558. Cultivators.<br>1 220 181. Cultivator shovel or tooth.<br>1 220 383. Motor-driven tractor-cultivator.<br>1 220 449. Self-adjusting coulter-wheel for ploughs.<br>1 220 475. Harrow.<br>1 220 485. Wheel attachment for harrows.<br>1 220 982. Power-interrupting device for tractors.<br>1 221 148. Riding attachment for harrows.<br>1 221 158. Riding harrow.<br>1 221 230. Disc harrow.<br>1 221 503. — 1 221 915. Coulters.<br>1 221 565. Cultivating implement.<br>1 221 764. Sidehill gang plough.<br>1 221 992. Sulky plough.<br>1 222 117. — 1 224 025. Tilling machines.<br>1 222 299. Traction plough.<br>1 222 387. Motor-plough.<br>1 222 388. Stalk chopper for maize.<br>1 222 517. Lifting mechanism for ploughs.<br>1 222 647. Power-driven agricultural implement for ploughing.<br>1 222 918. Drag-harrow.<br>1 223 029. Rotary plough.<br>1 223 145. Double disc harrow.<br>1 223 808. Slat mouldboard.<br>1 224 101. Brake for ploughs. |

### *Manures and Manure Distributors.*

- |                |  |
|----------------|--|
| Austria        | 73 594. Liquid-manure distributor.   |
| United Kingdom | 104 174. Process for converting phosphate rocks and potash-bearing rocks into a manure containing citrate soluble phosphates and potassium sulphate. |

- United States I 216 902. Manure Loader.  
 I 221 742 — I 222 208. Fertiliser-distributor.  
 I 221 863. Wide-spreading device for fertilizer distributors.

*Drills and Sowing Machines.*

- United States I 216 281. Clutch mechanism for corn planters.  
 I 216 377. Combined planter and cultivator.  
 I 216 419 — I 223 967. Combined planter und fertilizer distributor.  
 I 216 449 — I 222 386. Planters.  
 I 216 788 — I 217 011 — I 223 838. Corn planters.  
 I 221 192. Lister.  
 I 222 113. Peanut planter.  
 I 222 228. Cotton-seed planter.  
 I 222 884. Fender for seeders and planters.  
 I 223 142. Grain-drill.

*Various Cultural Operations.*

- United States I 221 974. Separator for soil.  
 I 222 122. Hand cultivator on wheels.  
 I 222 701. Weed-cutter.  
 I 223 868. Cotton-chopper.

*Control of Diseases and Pests of Plants.*

- Austria 73 467. Spraying and dusting machine for farm use.  
 United Kingdom 104 222. Device for destroying insects.  
 United States I 216 746. Spraying apparatus.  
 I 216 917. Boll-weevil destroyer.  
 I 222 706. Insect-destroyer.

*Reapers, Mowers and Harvesting Machines.*

- Austria 73 461. Hitch for a binder or other agricultural machine and a tractor  
 73 596. Reel for attachment to a reaper.  
 United Kingdom 102 039. Device for collecting rubber latex, etc., from trees.  
 104 301. Mowing-machine.  
 104 929. Harvester for maize, etc.  
 United States I 216 368. Grain-binder.  
 I 216 585. Header.  
 I 220 489. Lawn-mower.  
 I 220 931. Cotton-harvester.  
 I 221 119. Seed-harvester.  
 I 221 316 — I 221 364. Corn harvester and husker.  
 I 221 541. Hay-rake.  
 I 221 743 — I 221 820. Shocking-accessory for harvesting-machines.  
 I 221 980. Dividing board for mowers.  
 I 222 716 — I 222 730. Combined harvester and thresher.  
 I 222 717 — I 222 718 — I 222 796 — I 222 797 — I 222 798 — I 222 779.  
     *Shocking machines.*  
 I 222 815. Combined rake and tedder.  
 I 222 878. Fruit-gatherer.  
 I 223 999 — I 224 000 — I 224 003 — I 224 004. Harvesters.  
 I 224 114. Combined harvester.

*Machines for Lifting Root Crops.*

- Austria 73 462. Potato getting machine with mobile forks.
- Switzerland 75 127. Potato-getting machine.
- United States I 216 715 — I 222 098. Beet harvesters.
- I 220 977 — I 221 775 — I 222 099. Beet toppers.
- I 221 729. Potato-harvester.

*Threshing and Winnowing Machines.*

- Switzerland 74 938. Seed-sifting machine.
- United Kingdom 104 216. Threshing-machine.
- United States I 220 477. Pea-vine threshing and hulling machine.
- I 220 657. Grain separator.
- I 220 901. Self-feeder for threshing-machines.
- I 222 111. Seed grader.

*Machines and Implements for the Preparation and Storage of Grain, Fodder, etc.*

- Switzerland 74 912. Process for preserving green forage in silos.
- 75 129. Forage press.
- United Kingdom 103 327. Device for drying hay, etc.
- 104 418. Baling-press.
- 104 422. Harness.
- United States I 216 350. Travelling stock-gatherer.
- I 216 407. Feeding-attachment for baling presses.
- I 220 339. Hay-loader.
- I 221 220 — I 221 573 — I 221 625. Hay-presses.
- I 221 375 — I 221 491. Hay-stackers.

*Forestry.*

- United Kingdom 105 136. Firewood splitting machine.

*Steering and Traction of Agricultural Machinery*

- United Kingdom 104 447. Reversible racket clutches for driving the land wheels of agricultural implements.
- 104 586. Tractors.
- United States I 216 681. Motor-vehicle.
- I 217 022 — I 221 622 combination-evever.
- I 220 388 — I 221 320 — I 221 739 — I 221 975 — I 222 260 — I 222 335 —
- I 222 557 — I 223 505. Tractors.
- I 222 295. Tractor chain-tread.
- I 222 580. Adjustable clevis for agricultural implements.

*Feeding and Housing of Livestock.*

- Austria 73 592. Feed for hay-chopper.
- Switzerland 74 914. Moveable troughs for pigs, etc.
- 75 130. Process and apparatus for cleaning animals.
- 75 131. Device for closing mangers.
- 75 133. Reinforced concrete trough for liquid food.
- 75 134. Trough for wet and dry pig-food.
- United Kingdom 104 311. Restraint for weaning calves, etc.
- 105 042 — 105 097. Machines for making hois.shoes.
- United States I 221 484. Hog-oiling device.



*Dairying.*

- Switzerland 75 152. Hand-driven butter maker.  
 United Kingdom 104 995 .Stoppers for milk bottles.  
     • 105 093. Butter, cheese, and the like cutter.  
 United-States 1 221 483 — 1 221 634 — 1 222 826. Milking-machines.

*Farm Buildings.*

- United Kingdom 104 489. Ventilators for windows, doors, and walls.  
 United States 1 221 519. Pump for deep well.  
     1 222 849. Silo.

*Various.*

- United Kingdom 104 182. Device for wrapping-up potted plants.  
     105 043. Stirrup-strap suspenders.

## RURAL ECONOMICS.

665 - **Financial Statement of the Delaware Experiment Station Peach Orchard** (1).—  
 McCUE, C. A., in *Delaware College Agricultural Experiment Station, Bulletin* No. 113,  
 pp. 1-21. Newark, Delaware, June 1916.

The Delaware Agricultural Experiment Station has published a financial statement of its orchard of 1033 peach trees. The orchard, planted in 1908, covers an area of about 9  $\frac{1}{2}$  acres. The first crop was produced in 1912, and all the trees were bearing fully in 1915.

The report gives details of the cost of labour and material, and the expenses incurred per tree per acre, as well as the yield of the orchard per tree and per acre. As the orchard is used for experimental purposes, the expenses are necessarily a little higher than they would be were the orchard run on strictly commercial lines. Moreover, the estimate is based on fixed valuation of the labour of men and horses per hour for the 8 years; one of the great difficulties with which a commercial grower is faced, the distribution of work during the year, is thus avoided.

The details concerning the planting of the orchard, the methods used and expenses incurred, the crop and financial results may be summarised as follows:

The orchard was planted in 1908 in fresh, deep, arable soil. There are 9  $\frac{1}{2}$  acres of peach trees planted 20 feet  $\times$  20 feet. The varieties include 658 Elberta, 320 Belle of Georgia, and 55 Champion trees, 1033 trees in all. Six hundred of the Elberta trees were planted in 24 equal plots and used for 20 fertiliser experiments. Three hundred of the Belle of Georgia, divided into 12 equal lots, were used for 9 cover crop experiments. The remaining trees were used for other experimental work, such as spraying, etc. The year the orchard was laid out it was interplanted with maize, in the following years it was given clean culture and then seeded down to

(1) See also in *B.*, 1916, No. 440: Cost of running a peach orchard in North Carolina, U. S. A.  
 (Ed.)

TABLE I. — *Expenses of the Peach Orchard of the Delaware Agricultural Station for the Years 1908-1915 inclusive, and Average Expenses per Acre, per Tree and per Basket ( $\frac{1}{2}$  bushel).*

	1908	1909	1910	1911	1912	1913	1914	1915	Total	Cost per acre	Cost per tree	Cost per tree	Cost per basket
	dollars	dollars	dollars	dollars	dollars	dollars	dollars	dollars	dollars	dollars	dollars	dollars	dollars
1) Pruning and hauling brush . . . . .	1.50	4.50	10.00	38.00	59.76	121.90	104.56	133.48	473.70	49.38	6.198	0.4590	0.0573 0.029567
2) Spraying labour . . . . .	—	3.00	10.50	28.04	85.51	75.25	109.25	137.22	509.37	53.18	6.650	0.4930	0.0616 0.031768
3) Spraying materials . . . . .	—	0.80	16.45	19.80	47.40	47.84	70.33	76.72	279.34	29.22	3.650	0.2704	0.0338 0.017421
4) Cultivation and sowing cover crops . . . . .	27.00	52.13	57.74	76.20	42.71	63.11	41.36	51.88	411.83	43.68	5.385	0.0498	0.0498 0.025684
5) Mixing and applying fertilisers . . . . .	12.00	8.00	13.80	8.00	8.00	8.00	8.00	8.00	71.80	7.93	0.991	0.0730	0.0091 0.004727
6) Fertilisers . . . . .	55.58	62.00	66.36	58.50	52.50	49.31	56.74	53.92	454.91	47.58	5.945	0.4400	0.0550 0.028371
7) Cover crop seed . . . . .	—	12.00	12.00	12.35	12.00	12.50	12.50	13.75	87.10	9.10	1.138	0.0843	0.0105 0.005432
8) Weeding . . . . .	—	3.00	10.00	13.99	12.60	16.08	22.65	25.46	104.68	23.96	3.000	0.2218	0.0277 0.014288
9) Summer pruning . . . . .	—	—	—	18.99	71.13	25.60	—	8.70	124.42	80.58	10.072	0.7457	0.0932 0.048045
10) Harvesting . . . . .	—	—	—	6.82	82.35	59.39	237.04	384.76	776.36	109.51	13.668	1.0134	0.1267 0.005292
11) Packages . . . . .	—	—	—	1.00	94.20	56.00	40.70	485.00	1,046.99	240	0.310	0.0227	0.0029 0.001405
12) Hauling . . . . .	—	—	5.00	—	2.00	4.76	10.03	1.69	23.50	3.95	0.490	0.0360	0.0043 0.002353
13) Time on repair of tools . . . . .	—	—	—	—	7.72	5.87	15.08	9.66	37.73	0.60	0.075	0.0055	0.0007 0.000355
14) Repairing trees . . . . .	—	—	—	—	—	—	—	5.70	5.70	20.42	3.300	0.2450	0.0368 0.015750
15) Freight bills . . . . .	10.00	10.00	10.00	17.00	39.00	32.00	75.66	58.89	252.55	41.32	4.33	0.04	0.0050 0.002577
16) Cost of trees (at 4 cents each) . . . . .	41.32	—	—	—	—	—	—	—	—	52.68	5.51	0.690	0.0510 0.003285
17) Propping and thinning . . . . .	—	—	—	—	—	—	52.68	—	52.68	1.84	0.230	0.0170	0.0020 0.001094
18) Hoed about trees . . . . .	3.15	14.40	—	—	—	—	—	—	17.55	4.00	0.520	0.0390	0.0048 0.002404
19) Preparation of land for planting . . . . .	40.00	—	—	—	—	—	—	—	40.00	4.18	0.520	0.0390	0.0048 0.002404
20) Hoed . . . . .	7.85	—	—	—	—	—	—	—	7.85	0.82	0.100	0.0076	0.0009 0.000484
21) Planting . . . . .	17.50	—	—	—	—	—	—	—	17.50	1.83	0.230	0.0170	0.0020 0.001091
22) Cost of seed and planting corn crop . . . . .	6.00	—	—	—	—	—	—	—	6.00	—	—	—	—
23) Thinning and hoeing corn crop . . . . .	11.00	—	—	—	—	—	—	—	11.00	—	—	—	—
24) Harvesting corn . . . . .	30.00	—	—	—	—	—	—	—	30.00	—	—	—	—
25) Lime and application . . . . .	—	—	8.75	—	—	—	—	—	8.75	0.92	0.114	0.0080	0.0010 0.000545
<b>Totals . . . . .</b>	<b>262.90</b>	<b>169.83</b>	<b>222.60</b>	<b>299.29</b>	<b>616.88</b>	<b>578.52</b>	<b>1,286.60</b>	<b>1,454.29</b>	<b>4,890.91</b>	<b>506.58</b>	<b>63.316</b>	<b>4.6864</b>	<b>0.5855 0.302688</b>

cover crops. Spraying and summer and winter pruning are carried out regularly every year.

Table I gives the yearly cost of production for each separate process as well as the expenses incurred during the 8 years per acre, per acre per year, per tree, per tree per year, per  $\frac{1}{2}$  bushel. The invested capital and the interest on the capital are included in the financial statement. The figures in Table I represent the cash value of the work done by the labourers and animals, which has been estimated as follows: man labour per hour, 15 cents; labour of man and team per hour, 40 cents; labour of man and one horse per hour 27  $\frac{1}{2}$  cents.

Table II gives the quantity of peaches produced by the orchard during the 4 years 1912-1915, their price and their value. It should be noted that the 1913 harvest was partly destroyed by a hard spring frost.

TABLE II. — *Record of Peach Harvests from 1912-15 inclusive.*

Year	Numbers of baskets ( $\frac{1}{2}$ bushel)	Amount received dollars	Average price per basket, cents
1912 . . . . .	1 609	1 179.15	59.85
1913 . . . . .	1 132	1 083.00	76.66
1914 . . . . .	6 094 $\frac{1}{2}$	2 794.60	41.65
1915 . . . . .	7 199	2 542.54	28.13
<i>Total and averages . . .</i>	<b>16 034 <math>\frac{1}{2}</math></b>	<b>7 599.29</b>	<b>51.57</b>

The yield per tree and per acre for both picked and dropped fruit for the two varieties, Elberta and Belle of Georgia is given in Table III.

*Financial Statement:* The original cost of the land was approximately \$100 per acre, bringing the initial investment on 9.56 acres up to \$956.00. Compound interest at 5 % up to the end of the 5th year, the first in which a yield was obtained, is \$264.12. The total expenditure to the end of the 5th year is \$1522.08; if the interest on the land investment be added to this, there is, at the end of the 5th. year, a total expenditure of \$1786.20, as against a return of \$1179.15. The 6th. year, therefore, opens with a debt of \$607.05, which, at the end of the year, together with the year's expenses, interest and debts, equals a total of \$1292.65, as opposed to an income of \$1083.00. The debt at the beginning of the 7th. year is \$209.65. The expenditure at the end of that year is \$1554.53 and the income \$2784.60, there is, therefore, a profit of \$1240.07. The total capital invested at the end of the 8th. year is \$1502.09, the income \$2542.54, showing a profit of \$1040.45. The average yearly profit for the 8 years is \$285.06 or \$29.81 per acre, which is 29.8 % on the original investment. The profit per basket is 12.923 cents.



TABLE III. — Annual yield in  $\frac{1}{2}$  bushel baskets of the varieties "Elberta" and "Belle of Georgia".

Variety	Year	Yield per Tree			Yield per Acre		
		Picked fruit	Drops and Culls	Total Baskets	Picked fruit	Drops and Culls	Total Baskets
Elberta, . . . .	1912 . .	1.30	0.08	1.38	139.86	8.64	148.50
	1913 . .	1.65	0.10	1.75	178.20	10.80	189.00
	1914 . .	5.21	0.94	6.15	562.68	101.52	664.20
	1915 . .	5.62	1.61	7.23	603.96	173.88	777.84
Total		13.78	2.73	16.51	1484.70	295.04	1779.54
4-Year average . . . .		3.45	0.68	4.13	371.18	73.76	444.94
Belle of Georgia	1912 . .	2.19	0.09	2.28	236.52	9.72	246.24
	1913 . .	0.01	—	0.01	1.08	—	1.08
	1914 . .	5.88	0.75	6.63	635.40	81.00	716.04
	1915 . .	5.88	1.23	7.11	635.04	132.84	767.88
Total		13.96	2.07	16.03	1507.68	223.56	1731.24
4-Year average . . . .		3.49	0.52	4.01	376.92	55.89	432.81

## AGRICULTURAL INDUSTRIES.

666 — Experiments on the Deacidification of Wine, in Italy. — MENSIO, C., in *Le Stazioni Sperimentali Agrarie Italiane*, Vol. I., Pts. 3-4-5, pp. 225-244. Modena, 1917.

The author studied the chemical composition of a 1914 white Barbera wine. The acidity of this wine was so high (16.3  $\frac{\circ}{100}$ ) that it was almost undrinkable. The owner had kept a certain quantity at a temperature of 5° C. to see whether, a deposit of tartar would form. Another lot was kept at a temperature of 12°-20° C, to see whether heat would cause malo-lactic fermentation. As the composition of the wine did not change under these conditions the acid was neutralized by the addition of 660 gr. of potassium bicarbonate per hectolitre. The results of the analysis are given in 13 tables. An examination of these tables shows that, even wine in which the acid had been most vigorously neutralized and which also underwent strong malo-lactic fermentation, still contained free tartaric acid.

The practical conclusions obtained may be summarised as follows: The 3 wines studied were of a very peculiar composition. The two first were remarkable for their high percentage of organic acids, mostly in the free state, and for their very strong acid energy, which exceeded that hitherto found in wines of the same origin.

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PRODUCTS

The acid energy of these wines may be compared to that of an  $N/_{600}$  hydrochloric acid solution, although the values obtained for ordinary Italian wines range between those represented by  $N/_{1000}$  and  $N/_{3000}$  hydrochloric acid solutions.

The third wine was remarkable for its large quantity of combined organic acids and its very weak acid energy, barely equal to that of an  $N/_{8500}$  hydrochloric acid solution. The analytical results of the third sample show the disadvantages of using potassic salts for neutralizing acidity, and emphasize the necessity of calculating the quantity of acid-neutralizing salts, not by the total acidity of the wine, but by the total amount of tartaric acid it contains. Not more than  $\frac{2}{3}$  of this acid should be neutralized, and, preferably, only the half, so that the acidity of the wine shall not be lowered too much, because neutralization of acid is usually followed by a more or less vigorous malo-lactic fermentation.

In the wine examined the process should have been carried out as follows: total tartaric acid content 5.7 gr. per litre; tartaric acid to be saturated 3 gr. per litre or 300 gr. per hectolitre. Since 0.66 gr. of calcium carbonate neutralizes 1 gr. of tartaric acid, 200 gr. of calcium carbonate per hectolitre will be required. By this method the acidity and acid energy of the wine would not have been so greatly reduced as was actually the case, but the reduction would still have been sufficient to allow malo-lactic fermentation, and the wine would have been greatly improved. If, instead of calcium carbonate, potassium bicarbonate were used, about 200 gr. per hectolitre would have sufficed instead of the 660 actually used.

Not only in neutralizing acids, but also in estimating the acidity of wine, the acids it contains must be known and attention given to the possibility of malic acid of fermentation. It should be noted in this connection that the estimation of lactic acid is very important and should form part of the routine of all laboratories for the examination and analysis of wines.

667 - **The Reduction in Volume of Wine due to Fermentation.** — DE ASTIS, G., in *Le Stazioni sperimentali agrarie italiane*, Vol. I., Pt. 2, pp. 87-96, 2 figs. Modena, 1917.

The work described was carried out at the Chemical Laboratory of the "R. Cantina Sperimentale" (Experiment Cellar) of Arezzo, Italy.

There are many data on the decrease in *weight* of must during vinification as a result of alcoholic fermentation, especially when it is transported over long distances. In cutting wines this decrease in weight is known to vary between a minimum of 0 and a maximum of 13 %, according to whether the fermentation develops partly or wholly, or whether the must does not ferment.

As, on the contrary, there are no data on the decrease in volume, the author has determined this experimentally. He has established that the volume occupied by glucose in any must is equal to the weight of the sugar  $Z$  divided by 1.613 (density of the glucose).

The action of the fermentation gives, on one hand, a decrease in volume due to lost sugar, on the other hand, an increase in volume *a* due to the alcohol, and secondary volatile products formed at the expense of the



fermented sugar. The volume of alcohol produced by the fermentation exceeds the initial volume of sugar. There will, therefore, be an increase in volume during the transformation of the must into wine, so long as this is not prevented by a contraction in volume produced by the alcohol in the presence of water. It is well known that, by mixing 53.9 litres of absolute alcohol with 49.8 litres of a water, a volume equal to 100 litres is obtained, that is to say a contraction of 3.70 % takes place. Theoretically then, there is a contraction of  $3.70 : 53.9 = 0.686$  per degree of alcohol produced by the fermentation. The author has proved that, in practice, this contraction varies from 0.68 to 0.76 per degree of alcohol when mixed with water, dealcoholised wine or sweet must. The theoretical and practical coefficients, therefore, coincide fairly well.

It is, thus, possible to calculate the decrease from the fermentation per cent. of volume of the must into wine by dividing the percentage of fermented sugar by the density of the glucose (1.613), and subtracting from the quotient the volume of the percentage of alcohol multiplied by its contraction coefficient 0.686. To this decrease must be added that corresponding to the volume of the lees of the wine, a volume which varies in different wines, and which, in the wines examined by the author (white, Arezzo), varied from 0.41 litres to 0.73 litres, corresponding to from 0.68 to 1.12 kg. of dry weight per hectolitre of wine.

To sum up, for these two factors, the reduction in volume of the must into wine varied from 0.7 to 1.2 %; 1 % may be taken as a general average. From this calculation are excluded all other causes of reduction such as variations in temperature and pressure, evaporation, losses due to the processes, etc.

668 - Contribution to the Study of Apiculated yeasts. — KAYSER, F., in *Comptes rendus des Séances de l'Académie des Sciences*, Vol. 164, No. 19, pp. 739-741. Paris, May 7, 1917

The great need of alcohol of the French ministry of munitions, and the abundant apple crop of 1915, led to the use of apples either alone, or mixed with commercial beets, in distilling.

Amongst other difficulties, a certain antagonism was found between the yeast of grain and that of apples. There was also a large proportion of volatile acids and ethers. The author attempted to explain this by subjecting the must of mangolds and apples to fermentation under different conditions.

It was found that mangold must contains all the nutrients necessary for good fermentation, and that when added to apple must, which is deficient in nitrogen, it gave rise to complete fermentation.

Among cider yeasts some, round, oval, more or less long, are very active, and others, the *apiculated yeasts*, which are lemon-shaped, have a weak fermenting capacity (1). Acids have a very harmful effect on the first type, whereas the second type can stand their addition even in large

(1) The differentiation between the yeasts of cider was made in 1890 by Mr. KAYSER. — See G. WARCOLLIER, *Pomologie et Cidrerie*, Paris, Baillière, 1909. (Ed.)



quantities, but, under their influence, they are gradually transformed, and change their characteristic form for an oval or round one, at the same time collecting together in groups.

It was also noted that apiculated yeasts, though rare at the beginning of the season, occur in abundance in late apples.

As the diffusion of the mangolds requires the use of sulphuric acid, when the must of the mangolds is mixed with that of the apples, this sulphuric acid acts on the yeasts, thus diminishing the action of the vigorous yeasts and favouring the development of apiculated yeasts. The acid thus influences the fermentation products and gives rise to many volatile products (volatile acids and ethers).

The greater proportion of ethers found at the end of the season may, therefore, be accounted for by the abundance of apiculated yeast and its resistance to sulphuric acid, the amount of which is usually increased at this time.

The temperature at which the musts are fermented also influences the volatile ethers which are produced in larger quantities at high temperatures than at low ones.

When distilling a mixture of mangolds and apples, care should be taken not to add too large a proportion of sulphuric acid, and to use active yeasts, chosen amongst those which are most resistant to acidity, and to lower the fermentation temperature so as to eliminate, so far as possible, the action of apiculated yeast.

**669 - Simple Method for Estimating the Degree of Bolting of Wheat Flour. —**

PERRACINI, in *Le Stazioni Sperimentali Agrarie Italiane*, Vol. I., Pts. 1-4-5, pp. 250-252. Modena, 1917.

The regulations laid down for the analysis of flour in controlling the degree of bolting necessitates important work not exempt from difficulties which can only be carried out in laboratories of agricultural chemistry.

For general commercial use the author has devised a simplified method which gives satisfactory results which are sufficiently exact to be considered as a good preliminary test.

The method, which is the result of many experiments, is as follows :

The necessary apparatus consists of :

- a) a control sample of 85 % flour;
- b) two or three receptacles of uniform shape and capacity, of transparent, thin and very clean glass :
- c) a 1 % solution of copper sulphate (= 99 to 99.5 % pure).

5 gr. of the 85 % control sample are weighed out and 5 gr. of the sample under examination, and the two flours put into separate recipients. Equal quantities of copper sulphate are then added to the two flours which are rapidly shaken. The solutions are then left to stand with the matter in suspension; after 2 hours they are again shaken, and the flour then left to settle completely, which it does in 24 to 36 hours. If the solution of the flour to be tested is greener than that of the control flour it proves that the former contains more than 85 % flour. If on the other hand, it is of a bluish colour, it contains less than 85 %.

Finally, if the two solutions are of the same colour the bolting degree is the same. With practice the colour can be judged a few hours after the experiment has been started, but it is preferable to wait 2 or 3 days to make sure of the exactitude of the result.

By this method it is also possible to verify degrees of bolting superior or inferior to 85 %. All that is necessary is that the degree of the control flour be varied and this may be done even for 90 % flours.

The solution becomes greener in proportion as the amount of bran in the flour is greater ; fine flour, without any trace of bran, shows a distinct blue colour, pure bran, on the contrary, gives a yellowish green colour.

In a note published in the same number of the *Stazioni Sperimentali*, Prof. LO PRIORE points out that, in using colorimetric methods, a careful examination of the action of a 1 % copper solution on flour showed that all 85 % flours do not give the same colour. This depends on the quality of the wheat and the fineness of the pigmented layer of the pericarp after grinding. The reaction described by the author is, therefore, rather coloriscopic than colorimetric, and is more suitable for use as a preliminary test giving an approximate indication than as a rapid and reliable quantitative determination. Prof. LO PRIORE, in the same note, discusses the colorimetric quantitative determination of pentosans in flour (TESTONI'S method), and gives a bibliography of the most recent works on this question.

670 - **Quality of the Flour from Wheat grown in Dry or Irrigated Soils.** — See No. 632 of this *Bulletin*.

671 - **Sorghum Flour for Human Consumption : Investigations on its Digestibility.** — See No. 633 of this *Bulletin*.

672 - **Composition of the Juice of Hungarian Strawberries.** — SOMOGYI, MICHAEL and WEISER, STEPHAN (Communication from the Royal Station of Animal Physiology at Budapest), in *Zeitschrift für Untersuchung der Nahrungs- und Genussmittel*, Vol. 32, Part 9, pp. 408-411. Münster i. W., Nov. 1, 1916.

The forests of the Carpathians produce enormous quantities of strawberries ; in good years Hungary is capable of exporting the crude juice. In 1912, the amount exported was 4650 quintals (1 quintal = nearly 2 cwt.) chiefly to Germany. It is therefore interesting to know the composition of this juice. The writer has analysed 8 samples of unfermented juice, 17 samples of crude fermented juice, and 7 samples of juice obtained by a second presson with addition of water. The results of these analyses are given in the accompanying table.

These results show that the crude unfermented juice contains notable quantities of saccharose. The same thing has been noticed by JOULIN and CANU for French strawberries (2.01 %), whilst there are no data for German strawberries from this point of view. American strawberries also contain saccharose (0.80 %).

The juice obtained by a second presson had almost the same colour, aroma and taste as the crude juice of more inferior quality. Its taste however has more often a slight resemblance to that of acetic acid, even when the content of volatile acid is not in excess of that of normal juices.

*Composition of various juices of Hungarian strawberries.*

Juice and composition		Specific weight at 15°C	grams in 100 cc.										Alkalinity of ash		
			Dry matter	Invert sugar	Saccharose	Total sugar	Residue devoid of sugar	Ash	Nitrogen	Alcohol	Total acidity	Free acids	Volatile acids	per 100 cc. of juice	per gr. of ash
Unfermented juice	average . .	1.0550	14.26	8.65	1.04	9.69	4.59	0.488	0.055	—	—	22.78	—	6.62	13.51
	minimum .	1.0127	12.53	7.27	0.55	8.44	3.87	0.377	0.019	—	—	23.15	—	4.97	11.62
	maximum .	1.0181	16.02	10.50	1.62	12.12	5.31	0.691	0.105	—	—	33.98	—	9.35	16.81
Fermented juice.	average . .	1.0150	4.80	0.55	0.05	0.60	4.20	0.519	0.019	1.99	27.49	—	3.55	6.87	13.26
	minimum .	1.0127	4.37	0.40	0	0.40	3.74	0.412	0.010	1.44	24.02	—	2.49	5.70	12.46
	maximum .	1.0181	5.40	0.63	0.30	0.66	4.76	0.564	0.028	2.55	31.27	—	6.00	7.80	13.91
Juice obtained from 2nd. pres-sion with added water.	average . .	1.0127	3.95	0.44	0.05	0.49	3.46	0.407	0.022	1.35	22.09	—	3.61	5.42	13.23
	minimum .	1.0105	3.28	0.35	0.02	0.39	2.83	0.366	0.015	1.01	20.07	—	2.54	4.75	11.78
	maximum .	1.0174	5.30	0.71	0.07	0.78	4.52	0.506	0.028	1.66	30.23	—	6.47	7.90	15.6



673 - Oil from Plum Stones. — See No. 639 of this *Bulletin*.

674 - On the Interpretation of the Results of Analysis of Tomato Preserve. — GUARNIERI, P., in *Le Stazioni Sperimentali Agrarie Italiane*, Vol. I, Parts 3-4-5, pp. 245-249 Modena, 1917.

The writer enumerates the methods of analysis of tomato preserves; these include the determination of the following direct or relative values: dry extract — total ash — insoluble ash — alkalinity of the ash — density of the soluble portion — volatile acidity — total acidity — levulose — saccharimetric deviation — fibre — nitrogenous matter — matter containing phosphorous — potash — sodium chloride — oxalic acid; and the absolute values obtained by relating the relative values to 100 parts of dry extract (by multiplying the direct values by the constant coefficient for each preserve, this latter being the result of dividing the number 100 by the number representing the dry extract devoid of salt). He then develops the following considerations on the interpretation of the analytic results.

DRY EXTRACT. — The dry extract, devoid of salt, is sufficient of itself to give the degree of concentration of a normal preserve; considered in relation to its levulose content, it gives a prompt method of determining whether the preserve is made from fully ripe or unripe tomatoes, or even from tomatoes which have already undergone an appreciable amount of fermentation.

INSOLUBLE ASH. — A high insoluble ash content is an obvious sign of the use of tomatoes soiled with earth.

DENSITY OF THE SOLUBLE PORTION OF THE PRESERVE. — The relationship between increase of density due to the soluble substances of the preserve (properly corrected for salt) and increase of density observed in an aqueous solution containing the same percentage of levulose as the actual preserve, leads to the estimation based upon the ratio extract: levulose.

VOLATILE ACIDS. — Abnormal volatile acidity is a sign of deterioration.

FIXED ACIDS. — The relationship between fixed acids and the potash is an excellent piece of data for revealing the degree of maturity of the fruit in the preserve. The relationship is slighter the riper the fruit employed, since, as is already known, fruit with acid juice loses acidity as it ripens, owing to fixation of the potash. A high absolute fixed acid content is usually a sign of unripe tomatoes or of the addition of fixed acids, whether organic or mineral. It must also be borne in mind that the fixed acid content may also increase as the result of a degradation process of the carbohydrates. The acidity in ripe tomatoes is due to acid salts, the addition of fixed acids to the preserve is thus revealed by a comparison of the fixed acid content of the solution with the alkalinity of the ash.

LEVULOSE. — A feeble proportion of levulose is a sign of unripe tomatoes or of fermentation.

SACCHARIMETRIC DEVIATION. — A levorotatory deviation below the normal is a sign of either unripe tomatoes, fermentation, or the addition of glucose.

**FIBRE.** — An abnormal content is a sign of the use of unripe tomatoes or of careless preparation, resulting in the occurrence of skins and seeds in the preserve.

**NITROGENOUS SUBSTANCES AND SUBSTANCES CONTAINING PHOSPHOROUS.** — A high content of these substances means a preserve of good nutritive quality; the former on account of their high coefficient of digestibility, the latter as proof of richness in lecithin. A content of nitrogenous substances inferior to the limit is a sign of a preserve prepared with imperfectly ripe fruit, since it is common knowledge that a marked increase of these substances occurs during the last period of maturation.

**POTASH.** — A high potash content, while a sign of very ripe tomatoes, is a means highly recommended for estimating the value of tomato preserves.

**OXALIC ACID.** — The percentage of this acid is a valuable criterion for judging the state of maturation of the tomatoes employed.

675 — **Effects of Feeding Cottonseed Products on the Composition and Properties of Butter.** — See No. 651 of this *Bulletin*.

676 — **Pepsin in Cheesemaking.** — STEPHENSON, C., in the *Journal of Agriculture, New Zealand Department of Agriculture, Industries and Commerce*, Vol. XIV, No. 1, pp. 32-33. Wellington, January 20, 1917.

The present shortage of rennet is a serious menace to the New Zealand cheese industry. Experiments in the use of pepsin as a total or partial substitute for rennet were, therefore, made by the Dairy Division. The results obtained were entirely satisfactory.

In order to make a thorough comparison between the action of the pepsin and that of the rennet, the same class of milk was used in each experiment.

As soon as the milk reached the factory it was divided equally and poured into 3 vats. The milk in vat No. 1 was coagulated with pepsin, that in vat No. 2 with a mixture of pepsin and rennet, and that in vat No. 3 with rennet only. The pepsin was used at the rate of 2  $\frac{1}{2}$  drams per 1000 lbs. milk, and the rennet at the rate of 3  $\frac{1}{2}$  oz. per 1000 lbs. milk.

The curd in vats 2 and 3 was ready for cutting in 30 minutes, while that in vat 1, in which pepsin only was used, required 10 minutes longer before it was firm enough for cutting. No difference in the development of acidity was observed between the curds of any of the vats. The weight of cheese from each vat was practically the same.

The whey in vat No. 1, coagulated with pepsin, had a rather lower fat content than that of vats No. 2 and 3. This may be attributed to the slowness of the coagulation. This experiment, as well as later tests, shows that the action of pepsin when used alone is somewhat slow, even if it is added in larger quantities.

For this reason a mixture of pepsin and rennet is strongly recommended. Before being added to the rennet, the pepsin should be dissolved in 20 times its own weight of water; the mixture should then be diluted with

about half a bucketful of cold water before being stirred into the milk. If warm water is used its temperature should not be above 100° to 105° F. as the pepsin will, in this case, quickly lose its strength. Pepsin solution kept for any length of time becomes so weak as to be practically useless, and should always be prepared afresh 15 to 20 minutes before use.

The present price of pepsin is 18 s. to 19s. per pound, and that of rennet £ 3 to £ 3-5 s. per gallon. As 1 lb. of pepsin is practically equal to 1 gallon of rennet, its use presents distinct economic advantages.

The cheeses made with pepsin were of good quality, and no difference could be observed between them and those coagulated with rennet.

677 -- **Preservation of Timber.** — *The Colonial Journal*, Vol. 10, No. 4, pp. 306-308. London, April, 1917.

The sap which exists in the cells and vessels is the chief cause of the decay of timber, especially that which is put in the ground.

A brief survey of the processes used to preserve timbers is given. Special attention should be called to a new method, called "Powellising". By this method the green timber is placed in a bath containing a substance with a boiling point well above that of water, for example, molasses. This is heated till the molasses is hot enough to boil off the moisture in the green timber. The bath is then allowed to cool. If white arsenic be added, then the molasses absorbed impregnates the wood with this preservative when cooling.



## PLANT DISEASES

### GENERAL INFORMATION.

#### 678 - Decree regarding the Organisation of the Phytopathological Service in Italy. —

*Gazzetta ufficiale del Regno d'Italia*, Year 1917, No. 144, p. 2852. Rome, June 19, 1917.

Under date of April 25, 1917 the Italian Minister of Agriculture issued the following decree which entered into force on June 20.

Art. 1. — The Phytopathological Service is maintained by the Regional Observatories of Phytopathology, the names and districts of which appear in the list appended to the present decree.

Art. 2. — The Royal Inspectors of Plant Diseases have the power to inspect, at any time or place, the work entrusted to the delegates for the control of plant diseases by the order of March 12, 1916, No. 723 (1). At the same time they are obliged at once to communicate the result of their inspection to the Director of the Regional Observatory of Phytopathology.

Art. 3. — The regional delegates for Phytopathology only possess powers of control in the area administered by the Observatory to which they are attached. At the same time, whenever they may happen to see, outside their own area, plants or portions of plants on sale or being forwarded for the purpose of sale, infected by diseases rendering them liable to sequestration, it is their duty to have same confiscated by the local authorities, at the same time giving immediate information to the Director of the Observatory in order that further measures may be taken.

The following is the list of observatories accompanying the decree.

For the purpose of plant control Italy is divided into 21 districts. In each of these districts there will be either a special institute serving as regional observatory, or use will be made of another establishment already existing, with the aid of the necessary technical staff already attached to other agricultural institutions throughout the Realm.

1) TURIN: Royal observatory (autonomous) of Phytopathology, for the provinces of Turin, Novara and Cuneo;

2) CASALE MONFERRATO; Provincial observatory of Phytopathology for the province of Alessandria;

(1) See *B.* August 1913, No. 995.

- 3) MILAN: Laboratory of Plant Pathology of the Higher School of Agriculture, for the provinces of Milan, Como, Bergamo and Sondrio;
- 4) PAVIA: Royal Laboratory for Fungoid Diseases of Plants, for the provinces of Pavia, Cremona, Brescia, Piacenza and Parma.
- 5) CONEGLIANO: Natural Science Laboratory of the Royal School of Viticulture, for the provinces of Udine, Belluno, Treviso, Padua and Venice.
- 6) ROVIGO: Royal Experiment Station for Beet cultivation.
- 7) REGGIO EMILIA: Natural Science Laboratory of the Royal School of Zootechny and Cheese-making for the province of Reggio Emilia;
- 8) MODENA: Royal Agronomic Station, for the provinces of Modena and Mantua;
- 9) BOLOGNA: Laboratory of Plant Biology of the Royal University (Faculty of Agriculture), for the provinces of Ferrara, Bologna, Forlì and Ravenna;
- 10) VENTIMIGLIA: Royal office of Phytopathology, for the provinces of Porto Maurizio and Genoa.
- 11) FLORENCE: Royal Station of Agricultural Entomology, for the provinces of Massa and Carrara, Lucca, Florence, Pisa, Leghorn, Siena and Grosseto.
- 12) PERUGIA: Laboratory of Plant Pathology of the Royal Higher Institute of Agriculture, for the provinces of Perugia, Pesaro and Urbino, Ancona, Macerata and Ascoli Piceno;
- 13) ROME: Royal Station of Plant Pathology, for the provinces of Rome, Aquila, Teramo and Chieti;
- 14) AVELLINO: National Science Laboratory of the Royal School of Viticulture, for the provinces of Campobasso, Benevento and Avellino;
- 15) PORTICI: Laboratory of Agricultural Zoology of the Royal Higher School of Agriculture, for the provinces of Caserta, Naples, Salerno and Potenza;
- 16) BARI: Royal anti-phylloxera commission, for the provinces of Foggia, Bari and Lecce;
- 17) REGGIO DI CALABRIA: Royal Chair of Agriculture, for the provinces of Reggio and Cosenza;
- 18) PALERMO: Royal Institute of Colonial Botany, for the provinces of Palermo, Trapani and Girgenti;
- 19) ACIREALE: Royal Station for Citrus Culture (R. Stazione di Agrumicoltura), for the provinces of Messina and Caltanissetta, and for the districts of Acireale, Nicosia and Caltagirone.
- 20) CATANIA: Natural Science Laboratory of the Royal School of Viticulture, for the district of Catania and the province of Syracuse.
- 21) CAGLIARI: Natural Science Laboratory of the Royal School of Viticulture, for the provinces of Cagliari and Sassari.

679 - Decree by the Minister of Agriculture, in Italy, Regulating the Importation of Living Plants, Portions of Plants, Seeds and other Plant Products. — *Gazzetta ufficiale del Regno d'Italia*, Year 1917, No. III, p. 2379. Rome, May 11, 1917.

In view of the necessity of preventing the introduction of exotic diseases which might totally destroy certain home crops:

1) "black rot" of the grape (*Guignardia Bidwellii*); 2) "ink disease" of chestnut (*Endothia parasitica*); 3) "corky scab of potato" (*Spongospora Scabies*); 4) "black scab of potato" (*Synchytrium endobioticum*); 5) exotic dodders; 6) "potato leaf-curl"; 7) San José scale (*Aspidiotus perniciosus*); 8) "citrus scale" (*Lepidosaphes gloverii*); 9) Potato Tineid (*Lila solanella*) 10 and 11) American Coleoptera attacking the potato (*Doriphora decemlineata* and *Epitrix cucumeris*).

and to prevent the introduction into the realm of other unforeseen diseases by means of soil or seeds, the Minister of Agriculture, under date April 25, 1917, has published the following decree which entered into force on May 12, 1917:



Art. 1. — The importation from abroad of living plants, portions of plants, seeds and other plant products intended for cultivation or reproduction, can take place through the Customs houses at Milan, Turin, Ventimiglia, Genoa, Rome, Naples, Catania, Palermo, Cagliari.

Art. 2. — Parcels containing the above products, presented at other Customs Houses, are to be refused. They can, however, be re-forwarded to the nearest Customs mentioned in art. 1, provided the senders, express to the Customs officials their readiness to pay the necessary expenses for same.

Art. 3. — The above mentioned parcels on arrival at one of the Customs listed in Art. 1, are allowed to enter the country after examination by a special delegate for Phytopathology, nominated by the Minister of Agriculture to the local customs authority in conformity with Art. 18 of the Order of March 12, 1916, No. 723.

Art. 4. — Whenever a parcel is allowed to be imported, the contents are subjected by the delegate to the precautionary measures anticipated by articles 18, 20 and 21 of the Order of March 12, 1916, No. 723.

Art. 5. — Citrus plants and portions of same, except the fruits, of whatever origin, certified by the delegate as free from any of the diseases enumerated above or any of the local diseases entailing sequestration, are allowed to enter, but must first, in virtue of art. 20 of the Order of March 12, 1916, No. 723, be submitted to quarantine.

Art. 6. — The measures noted in art. 5 are applicable to all fruit plants or portions of same, except fruits from Canada, United States of America, Chili, Hawaiian Islands, Japan, China, Australia and Germany.

Art. 7. — Seeds for reproduction must first be disinfected under the care of the delegate for phytopathology in accordance with instructions from the Ministry of Agriculture.

Art. 8. — Seeds of forage plants are allowed entrance after examination has shown the absence of dodder.

The statement of purity is given by the special delegate or by a Government laboratory entrusted with the work of control.

Art. 9. — Importation of the following plants or parts of same is suspended.

- a) cuttings and rooted cuttings from European or American vines, from France, Spain, United States and Canada; existing antiphyllloxera measures remaining valid;
- b) seedlings, bark and branches with bark of chestnut from the United States.
- c) fresh fruit of any kind from the following countries: Canada, United States, Chili, Hawaii, Japan, China, Australia, Germany;
- d) citrus fruits from all foreign countries.
- e) potato tubers from all foreign countries.

Art. 10. — Vegetable products for food purposes and for manufacture, except those mentioned in art. 9, are allowed to be imported through any customs in the kingdom, the measures prescribed by art. 17 of the order still remaining in force.



## DISEASES DUE TO FUNGI, BACTERIA AND OTHER LOWER PLANTS.

680 - **Bacteria and Fungi Parasitic on Cultivated Plants, Observed in 1915 in the Province of Turin and Neighbourhood** (1). — VOGLINO, PIERO, in *Annali della R. Accademia di Agricoltura di Torino*, Vol. LIX (1916), pp. 251-263. Turin, 1917.

GENERAL.

The writer enumerates over 70 plant parasites, the majority of which are fungi.

The following merit particular notice : 1) disease on the trunk of *Celtis australis*, observed at Nole Canavese, from which were isolated a few bacterial forms, apparently the cause of the trouble ; 2) a bacteriosis of the pepper plant, in which the bacterium isolated is distinct from the *Bacillus Solanacearum* ; 3) the value again demonstrated of sprayings with a 1 % mixture copper sulphate and lime, repeated at intervals, on pepper seedlings in hot beds, before transplanting, as a preventive of *Phytophthora Cactorum* ; 4) the disastrous and almost general development of *Plasmopara viticola*, due to atmospheric conditions and absence of preventive treatment ; in early July, only those bunches were healthy that were protected from the rain, e. g. those of vines occurring under the verandahs of country houses. The same thing was noticed even in places where no treatment had been given. On the bunches of "Isabella" stocks, which were badly attacked by the disease, the conidia measured 26 - 30 × 14 - 16 - 18 μ, rarely 20 - 26 × 14 - 16 μ ; on the leaves of native vines the largest conidia did not exceed 24 × 14 μ with an average of 18-20 × 12 μ ; upon a tendril of an Isabella vine the conidia were 22 μ long and 14 μ broad. The *Plasmopara* infection, in the first 10 days of July, had destroyed 50 to 60 % of the bunches. Damage was checked to a large extent by treatment with sulphur mixed with copper sulphate and gypsum in the proportion of 7 parts of sulphur to 2 of copper sulphate and 1 of gypsum ; 5) the appearance of *Herpotrichia nigra* on *Pinus austriaca*, in the Valentino park, Turin ; 6) the value of careful spraying with "pasta Caffaro" or a 1 % mixture of copper sulphate and lime, in order to limit the damage caused by *Ascochyta hortorum* to eggplants, tomatoes, etc.

681 - **Fungi of Portugal and Angola, Africa.** — DE SOUSA DA CAMARA, EMMANUELE, in *Ministero de Fomento, Boletim da Direcção Geral da Agricultura*, Year 13, No. 3, pp. 1-29, plates I-III in colours. Lisbon 1916.

The fungi occurring most frequently on cultivated or useful plants in Portugal are as follows :

1) 4 species new to science : *Placosphaeria Almeidiana*, on the stems of *Dahlia variabilis*, in the Coimbra Botanical Garden ; *Sphaeropsis Bougainvilleae*, on the branches of *Bougainvillea spectabilis*, in the same locality ; *Diplodia Traversiana*, on the leaves of *Myginda Rhacoma*, again in the same locality ; *Rhabdospora Molleriana*, on the leaves of *Celtis australis*, near Coimbra, Cêrca de S. Bento ;

(1) See also B., June 1915, No. 650.

(Ed.)

2) Another form new to science : *Phoma Ilicis* Sacc. f. *Mygindae*, on branches of *Myginda Rhacoma*, in the Coimbra Botanical Garden ;

3) 24 micromycetes not so far mentioned in the Portuguese list : *Puccinia Phragmitis* (Schum.) Körn, on leaves and stems of *Arundo Donax*, near Villa Franca de Xira ; *Entyloma hieronense* Har. and Pat., on stems of *Poa* sp., in the garden of the Lisbon Agronomical Institute ; *Physalospora pustulata* Sacc. on leaves and petioles of *Aucuba japonica*, in the Coimbra Botanical Garden ; *Stigmatea lauricola* Rehm on branches of *Laurus nobilis*, near Coimbra, Cêrca de S. Bento ; *Metasphaeria culmifida* (Karst.) Sacc. on stems of *Milium multiflorum*, in the same locality ; *Massaria Aesculi* Tul., on branches of *Acer campestre* in the Coimbra Botanical Garden : *Cystopus Tragopogonis* (Pers.) Schr., on leaves of *Tragopogon* sp., in the garden of the Agronomic Institute of Lisbon ; *Macrophoma acaciaecola* Pat., on leaves of *Acacia* sp., near Cascais (Estoril) ; *M. Eriobotryae* Pegl., on leaves of *Eriobotrya japonica* near Parede (Cascais) ; *M. Penzigii* Ferr., on bark of *Populus alba*, near Malveira (Tôrres Vedras) ; *M. smilacina* on leaves of *Smilax aspera*, near Colares (Sintra) ; *Phoma insularis* Cke. and Mass., on leaves of *Aucuba japonica*, in the Botanical Garden of Coimbra ; *Ph. Rosarum* Dur. and Mont., on branches of *Rosa moschata*, near Coimbra ; *Ph. Smilacis* Boy. and Jacq., on leaves of *Smilax aspera* near Colares ; *Phyllosticta cicerina* Prill. and Del., on leaves of *Cicer arietinum*, near Vila Viçosa (Alentejo) ; *Coniothyrium Dasylirii* Celotti, on leaves of *Dasylirion acrotrichum*, in the Botanical Garden of Coimbra ; *Diplodiella Goetheana* Trav., on leaves of *Chamerops humilis*, near Monchique (Algarve) ; *Hendersonia Oleae* (Speg.) Sacc. and Trott., on leaves of *Olea europaea*, near Castelo de Vide ; *Septoria calycina* Kickx, on peduncles and calices of *Dianthus Caryophyllus*, near Cartaxo ; *Colletotrichum Lindemuthianum* (Sacc. and Magn.) Br. and Cav., on pods of *Phaseolus vulgaris* near Cascais (Quinta de Caparide) ; *Gloeosporium Spegazzinii* Sacc., on leaves of *Citrus Limonum*, near Vila Viçosa ; *Gl. triviale* Speg., on leaves of *Crinum giganteum*, in the Botanical Garden of Coimbra ; *Pestalozzia lignicola* Cke., on leaves of pods of *Acacia* sp. and *A. melanoxyton*, near Coimbra, Cêrca de S. Bento ; *P. strobilicola* Speg., on leaves of *Pinus Pineae*, near Trafaria.

There follows on the above a description of *Rabenhorstia Raphiae* n. sp., observed on the petioles of *Raphia textilis*, near Landana (Angola), in association with *Phoma herbarum* West.

682 - Practical Means of Control of the "Oidium" of the Oak. — DANIEL, LUCIEN, in *Comptes rendus hebdomadaires des séances de l'Académie des Sciences*, Vol. 164, No. 25 (June 18, 1917), pp. 957-959, Paris, 1917.

The experience of the writer, derived from his numerous observations in France on the "Oidium" of the oak, is that the development of the fungus and the relative intensity of the attack are in direct relationship with the state of health of each particular tree and with the method of management for the production of faggots.

On many farms the branches of oak are cut back every 7 years to the bare trunk and the crown removed, which results in the formation of clus-



ters of short branches. In other localities the tree is decapitated towards the middle, at heights which vary, and the trunks then resemble pollards.

These two processes radically destroy the normal balance of growth.

The root-system remaining intact, nutritive matter from the soil continues to be conveyed to the aerial portions of the plant; branches are formed which become covered with leaves, the object of which is to remove the excess of water in the tissues. The balance is only restored slowly, possibly several years being required. The result is that, until equilibrium has been re-established, the tissues of the oak contain a greater quantity of water than usual and the tree suffers from this excess in a greater degree the greater the relative difference in efficiency between the absorbent and the assimilating portions of the plant.

As a consequence, trees which have been newly cut back are attacked in a greater degree than those cut the preceding year and these latter are less resistant than those cut several years previously; finally, trees which have not been touched at all suffer least from the "oidium".

In view of the spread of the "oidium", the present system of management should be replaced by another which allows a certain number of branches to remain at the crown of the tree and which only involves cutting shoots issuing from the lower part of the trunk. The branches of the crown become covered with leaves as normally and draw the nutritive elements to this point, at the same time evaporating off the water.

In this way the balance of nutrition consequent on the cutting is less disturbed and, in addition, the crown of the tree, receiving more moisture, does not wither in the manner that occurs after removal of the crown and an attack of "oidium". Considerably less is to be feared from this latter as, owing to the lesser amount of water in its tissues, the tree makes a better resistance.

This method has been tested in various districts in the west of France and has given the results anticipated by theory. It is profitable to the farmer as bigger and better wood is obtained. Farmers hesitate to employ it, however, as it gives a somewhat smaller quantity of faggots. As this system constitutes the only practical method for combating the disease, its adoption should be rendered compulsory.

683 - **Patents Relating to the Control of Diseases and Pests of Plants.** — See No. 664 of this *Bulletin*.

684 - ***Fusarium tracheiphilum* Parasitic on Soy-Bean (*Soja max*) in North Carolina.** — CROMWELL, RICHARD O., in *Journal of Agricultural Research*, Vol. VIII, No. 11, pp. 421-440, Fig. 1. Pl. 95. Washington, D. C., March 12, 1917.

The description of a cryptogamic disease of *Soja max*. (L.) Piper (syn. *Glycine Soja* Sieb. and Zucc., *S. hispida* Mönch, etc.) studied in 1915 and 1916 in North Carolina and popularly known as "bean blight" or "soy-bean wilt".

The disease is characterised by a chlorosis and shedding of the leaf or leaflets, followed by the death of the plants. It has been observed in several localities in North Carolina on soils infected with *Fusarium trachei-*

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*philum* Smith which causes the disease of *Vigna sinensis* Hassk, commonly called "cowpea wilt".

Soy bean wilt is also due to a *Fusarium*, and cultural, as well as morphological studies have proved that the fungus which attacks soy-beans is identical with the organism producing wilt of *V. sinensis*.

Reciprocal inoculation experiments conducted in the greenhouse and under field conditions with the micromycete from soy beans and that from cowpeas shows the identity of the two *Fusarium*.

Infection probably occurs through the roots, but Nematodes do not seem to increase materially the percentage of diseased plants. The character of the soil appears to influence the percentage of infection, since the largest proportion of infected individuals appeared in coarse sandy soil.

685 - *Melanconium Sacchari*, the Cause of the "Rind Disease" of the Sugar Cane. — JOHNSTON, JOHN R., in *The Journal of the Board of Commissioners of Agriculture*, Porto Rico, Vol. I, No. 1. pp. 17-47. pl. I. San Juan, P. R. 1917.

The sugar cane disease known under the name of the "rind disease" has, as a result of investigations carried on during the last 20 years, been recorded from different parts of the world: the southern portion of the United States of America, Cuba, Jamaica, San-Domingo, Porto Rico (where, according to the writer, it is widespread), Barbados, British Guiana, St. Vincent, Antigua, Nevis, Argentine, Mauritius, British India, Tonquin, Java, Natal, Queensland, New South Wales and Hawaii (1).

The disease is caused by *Melanconium Sacchari*, a fungus having, as far as is known at present, only one spore-form in its life history.

The symptoms of the rind disease are eruptions on the rind of the cane from which protrude black masses of conidia, together with a drying up of the leaves.

*M. Sacchari* is a wound parasite, *i. e.* capable of infecting cane only through wounds produced by insects or other cause. It may be classed as an active parasite on certain weak, or soft, canes, such as Bourbon and "D. 116".

Treatment of the disease is restricted to the use of hardy varieties, to adopting such methods as will reduce the moth borer and to grinding the cane before it is over-ripe.

Two other species of *Melanconium* have been found on sugar-cane and are described: *M. saccharinum* and *M. Ilian* (2), but they cannot be regarded as the cause of "rind disease". A bibliography of 39 works is appended to the article.

686 - On the Causes of Root Rot of the Mulberry and Protective Measures in Piedmont, Italy. — VOGLINO, P., in *Informazioni Seriche*, Year IV, No. 5, pp. 97-104, Rome, March 5, 1917.

Owing to the serious damage caused by root rot of the mulberry in various parts of Piedmont, the Minister for Agriculture, on the proposal of

(1) See on this subject *B.* July 1911, No. 2357

(2) See *B.* February, 1913, No. 187. (Ed.)

the Council for sericultural interests, has given to the author, Director of the Phytopathological Observatory of Turin, the task of studying, in 1914, 1915 and 1916, the causes of the disease and suitable measures to be used.

Observations on specimens obtained from various localities in Piedmont have shown that two fungi: *Armillaria mellea* Vahl and *Rosellinia necatrix* (R. Hartig) Berlese, were present on diseased mulberry trees.

The disease attacks both young, planted-out trees and trees up to 40 and more years old. *R. necatrix* was usually found on young, planted-out trees, as well as nursery plants.

Root rot produced by *A. mellea* shows four different stages in its attack: a) infection commences in autumn, the leaves yellowing partly in the following spring; in the second year, development is much restricted; in the third, the plant gradually declines more and more, dying in summer; b) the plant infected in autumn dies the following autumn; c) yellowing of leaves in spring and death of the plant in autumn; d) sudden death of a vigorous plant.

Sometimes the rot commences in the collar region, sometimes at the tip of the roots and even in the principal roots; in every case, it attacks three regions of the plant: collar, roots and trunk, the latter up to 20-30-60 cm. above the soil, according as the disease dates back 2 or more years. The disease causes the bark to become loose in the infected region and also causes other phenomena in the rotted wood.

In the collar-region there is abundant secretion of a yellowish liquid; in the root, between the cortical layers, a white, downy felt forms which continues in black, hard plates and in long, black rhizomorphs; on the trunk, the bark, in falling off, leaves whitish and black scales.

The fructifications of *Armillaria* develop all round the dead plants after the rotting of the roots.

In 1914-15, in connection with the yellowish brown plates, small hard, dark, prominent growths were observed on the stems attacked by the rot. The growths at first contained pycnidia of *Cystosporina ludibunda*, Sacc., and, eight months later, perithecia of *Eutypa ludibunda*, Sacc. The hyphae, which form brown and white plates, destroy the cambium and part of the wood; they are in direct relation to the above-mentioned fructifications, and a sequence of the fungoid plates which ascend the collar from the point where the rot commences. Experiments are now being made to determine the action of *C. ludibunda*. At the present time *E. ludibunda* is known as a saprophyte of the branches and trunks of many trees, causing the cortical to separate easily from the wood.

The fructifications of the other fungus (*Rosellinia*) which causes the rotting of the root, have been found in the black growths (sclerotia) which emerge from the parts of the root which are already dead. These sclerotia give off conidiophores consisting of filaments, stiff and brown in the lower part, and light in the upper part; they show lateral, egg-shaped, colourless conidia.

The rot caused by *Rosellinia* only attacks the root. Damp surroundings and soil rich in fertilising matter favour the growth of the fungus. As



in the case of *Armillaria*, the first symptom of the disease is a yellowing of the leaves.

There is little doubt of the parasitic nature of the root rot, but it must not be forgotten that, each year, the mulberry is stripped of its leaves and closely pruned, thus being so weakened that the attacks of parasites are made easy.

When, at the period of its greatest strength, the leaves and branches are removed from the plant, the lack of equilibrium in the circulation of nutritive matter causes abnormal secretions, particularly round the collar, and, consequently, brings about conditions very favourable to the development of *Armillaria* hyphae, as a result of the rhizomorphs in the soil. If there is a very great lack of equilibrium the sap is largely absorbed by the mycelium of the fungus, the nutritive matter cannot reach the new leaves, and the plant invariably dies.

Rot of the roots is connected, not only with the systems of cultivation, but with certain favourable conditions of the soil in which the mulberry is planted. Usually soil, rich in organic matter and good from an agricultural point of view, favours the growth of the parasites; infection is also favoured by sandy or moist soils which are difficult to drain, and particularly by those with stagnant sub-soil water.

As root rot is contagious it is wisest to leave ground in which infected mulberry trees have died empty for at least two years, or to give it up entirely. It is well to tap the trees in spring by means of holes or longitudinal incisions, so as to remove the juices which the plant cannot absorb because of the recent removal of the leaves; the wounds should be treated with a 10 to 20 % ferrous sulfate solution. Siftings or small quantities of calcium cyanamide should be spread round the base of the tree.

Owing to the many circumstances which render the plant susceptible to root rot it is very difficult to fight the disease. Experiments on the subject are being carried out, but it will be impossible to obtain results for a few years.

It is necessary to increase the cultivation of mulberries as bushes, to form local nurseries and to practice rational annual pruning.

687 — *Phoma endogena* a Spheropsid Parasite of the Chestnut in Piedmont, Italy. — VOGLINO, P. and BONGINI, V. in *Annali della R. Accademia d'Agricoltura*, Vol. LX, 12 pp. 3 figs, 1 pl. Turin, 1917.

This is a preliminary note on a disease of chestnuts which, for some years past, has been observed on the hills near Turin. The pericarp of the achenes, shortly after the completion of storage, becomes completely detached from the seed as the result of shrinkage of this latter, and shows a number of lumps and hollows. The embryonic axis turns brown, while the cotyledons retain their normal whitish colour but become extremely hard, as if calcified, and under pressure from a blade, break rather than allow themselves to be cut. In this state the chestnuts are extremely difficult to cook — boiling for 2 hours being insufficient — and, in addition, they acquire an unpleasant flavour which renders them almost inedible.



In chestnuts attacked by the disease removal of the pericarp and of the seed coat (easily performed) shows the cotyledons covered with a white coat caused by the matting together of the mycelial filaments, which are particularly abundant in the hollows and fill the small spaces and channels between the seed-coat and the cotyledons. On the raised portions of the cotyledons the investment formed by the hyphae becomes thinner and along the dorsal line may be completely absent, the dorsal line then often showing superficial brown patches. In the midst of the felted mycelium there occur numerous pycnidia, occasionally these are isolated but more frequently they are united into pseudostromatic formations, which, when completely formed, have the appearance of round corpuscles, reddish grey in colour when in process of formation.

These fructifications exist, not only on the surface of the cotyledons, but also constantly on the wall of the distinct cavity caused by the shrinking of the cotyledons. They also occur along the narrow channels which radiate from the centre of the cavity towards the periphery; on the other hand, they rarely develop on the seed-coat.

The pycnidia described above have been identified by the writers as those of *Phoma endogena*, a fungus discovered by SPAGAZZINI on ripe chestnuts at Conegliano (Venetia) and also observed later at Lyons, France.

Microscopic examination of sections cut in various places through the more or less internal portions of the cotyledons has demonstrated the parasitic nature of the fungus, the mycelium invading the whole of the cotyledon tissue.

The *Phoma* spores, grown at a temperature of 15-17° C. in drops of a sterilised decoction of chestnuts placed upon a glass slide or plated on gelatine, germinate very rapidly and give rise to a mycelium fructifying by means of pycnidia. Germination only proceeds very slowly in water and produces nothing else but a short mycelial filament.

Artificial infection of healthy chestnuts by means of the mycelium and spores of the fungus grown in a culture, has shown that infection occurs after dehiscence of the burr, especially along the little crevices which may occur in the pericarp, and particularly near the smooth apical zone of the fruit or in relation with the same. The fungus, however, has no destructive action on the pericarp.

## WEEDS AND PARASITIC FLOWERING PLANTS.

688 - Observations on the Cause of the Noxious Effect of Weeds. — See No. 625 of this *Bulletin*.

689 - *Centaurea solstitialis* and *Soliva sessilis*, Weeds of New South Wales (1). — MAIDEN, J. H., in *The Agricultural Gazette of New South Wales*, Vol. XXVIII, Part 3., pp. 181-184, 2 Coloured Plates. Sydney. March 1917.

A description of 2 Compositae: *Centaurea solstitialis* L. (St. Barnaby's Thistle) and *Soliva sessilis* Ruiz and Pav.

The first of these plants is a native of Europe, North America and Western Asia. It has become extensively distributed in Australia, having been recorded from practically every State. In New South Wales, it has been reported as occurring in western localities such as Richmond and Bathurst, and in southern, such as Burrinjuck and Qucanbeyan. As a rule, it is looked upon as a weed and the advice is given to eradicate it when it is in flower.

*S. sessilis*, while a native of Chili, has spread extensively in other parts of South America, and also in California. It is now widely distributed in sub-tropical countries. It is impossible to say when this plant first came to Australia. New South Wales has had direct traffic with South America for many years and it is very likely that *S. sessilis* was introduced into the State more than half a century ago, either by imported animals, or through human agency.

When this plant is present in quantities, it is too costly to deal with, except in the case of valuable lawns. In such cases, it can be got rid of, partly by means of a sharp trowel, and partly by encouraging the growth of the grass by top dressing, or the use of a stimulant, as sulphate of ammonia, which will cause a heavy and smothering growth of grass.

## INJURIOUS INSECTS AND OTHER LOWER ANIMALS.

### GENERALITIES

690 - **Invasions of Locusts in Uruguay, in 1915 and 1916.** — REPÚBLICA ORIENTAL DEL URUGUAY. MINISTERIO DE INDUSTRIAS. DEFENSA AGRÍCOLA. *Memoria de los trabajos realizados contra la langosta. Invasión del 1915-1916.* 1 vol. in-16, 444 pp., 36 maps, 28 figs. Montevideo, 1916.

A summary of the locust question in Uruguay, based on information supplied by the Government of that country, has already been given in the volume published by the International Institute of Agriculture (I).

The present report merely deals with the invasions of "langosta" which occurred in Uruguay in 1915-16 and which were more severe and more general than any hitherto known in the Republic.

The "Defensa Agrícola", thanks to information received from the Argentine predicting an early appearance of the pest in the country, was able to carry out in time propaganda and organisation work and to obtain all the help possible from private and official sources in view of the coming work of control. In 1915, an appeal was printed and distributed among the agricultural population, and also a publication containing practical instructions for fighting the locusts. Postcards were also distributed for collecting information as to the route followed by the insects and the state of development of the "langosta". An appeal was made for the help of public authorities, of the army, the railway companies, in order to augment

(1) See: *La lutte contre les sauterelles dans les divers pays.* Rome 1916, passim (B. Jan. 1917, No. 105). (Ed.)



the permanent staff of the "Defensa Agrícola". Commissions were formed throughout the republic in order to direct the work of control.

Winged swarms, coming in 1915 from the Argentine and Brazil, invaded the northern provinces and those along the Uruguayan littoral, whence they gradually spread throughout the country until not a single district remained which had not suffered in a greater or less degree. The general direction taken by the locusts was from north-west and north to south-west and south. The first province invaded was Artigas (August 19) and the last, Montevideo (November 25).

Owing to the continuance of the hot, dry weather, these invasions were followed by others, in 1916, coming from the Argentine. These latter lasted from March 25 to May 27, a thing so far unknown in "langosta" invasions. The provinces particularly visited in 1916 were Paysandú, Artigas, Salto, Soriano, Flores, Durazno and Florida.

On their arrival in Uruguay the locusts which, generally speaking, were little troubled by disease or parasites, deposited their eggs chiefly by the banks of streams; in many cases, however, probably on account of the size of the swarms, the eggs were laid in fields. Owing to the extraordinary development of the larvae ("mosquita" and "saltona" according to the state of development) it was very difficult to have recourse to expedients and to obtain really satisfactory results everywhere.

The material for the campaign of control at the service of the "Defensa Agrícola" having proved insufficient, it was necessary to make important purchases of raw materials on the Buenos Aires market; further, 140 workmen were employed at the Sayago depôt on the careful preparation of the material which was then impartially distributed by the "Defensa Agrícola" throughout the various provinces.

Instruments known as "látigos" proved particularly efficient against locusts at breeding time; cloths, etc. were also employed. The "látigos" are formed of a metallic net fixed to a wooden grip, the insects then being struck as by a broom; 18000 "látigos" were employed in the 1915-16 campaign. However, the destruction of locusts during copulation, however easy, is not generally adopted. In many parts of Soriano, Colonia, Paysandú and Salto, good results have been obtained by collecting the eggs.

The special blow-lamps ("máquinas a fuego"), of which 7835 were employed by the "Defensa Agrícola", have proved the most efficient for the destruction of the insect in the "mosquita" state. They work by ejecting naphtha which ignites on leaving the nozzle. The "Defensa Agrícola" has distributed 20 000 tins of combustible.

Metallic fences are acknowledged to be indispensable against the "saltona".

The method of control most employed in the 1915-16 campaign was that of fences and ditches. This is at once the most effective and most economical method of campaign; 550 000 metres of fencing have been prepared.

Various new apparatus and modifications of old systems have been examined by the "Defensa agrícola".

With regard to the various insecticides tested against the "mosquita"



the best results have been given by an emulsion of petrol in water and by a 8-10 % solution of potash in water.

Treatments based on molasses and arsenic, so much employed in Africa and elsewhere, have also been tested in Uruguay but so far not in sufficiently conclusive a manner.

It is worth noting that, in the departments of Montevideo and Canelones, where the campaign has been carried out right from the start in a regular manner with the cooperation of all concerned, the damage done to crops has been negligible.

The 1915-16 campaign involved an expense of 226 745 " pesos ".

#### MEANS

#### OF PREVENTION AND CONTROL

691 - *Prospaltella Berlese* against *Diaspis pentagona*. Observations in Piedmont during 1916 (1). — VOGLINO, P., in R. Osservatorio di Fitopatologia di Torino (Autonomo), Relazione del Direttore, 11 pp. Turin, 1917.

The observatory of Phytopathology of Turin in cooperation with the « Associazione serica e bacologica del Piemonte » has continued the work of control of *Diaspis pentagona* by means of *Prospaltella berlesei*. The work has been directly commissioned by the Government.

In March, under the supervision of the observatory staff, 115 745 branches covered with *Prospaltella* were distributed among the provinces of Turin, Coni, Alexandria and other localities.

The following June, the writer, who is Director of the Observatory, began an inspection of the mulberries in order to establish to what extent the *Prospaltella* had spread through Piedmont and whether it was advisable to increase its numbers. As usual, the degree of "prospaltisation" was observed in relation with the *Diaspis* infection, while taking into account the age of the infected branches and the general conditions of the mulberry trees. Samples were taken from various localities and sent to the observatory for examination.

The following conclusions are made :

1) Generally speaking, a new invasion of *Diaspis* may be said to have taken place in 1916 throughout the whole of the region in question.

2) there is, however, no need for alarm at the frequent reappearance of this scale-insect in Piedmont, nor to doubt the good effects of the *Prospaltella* ; if the *Diaspis* has again occurred in considerable numbers, the reason is to be found in the particularly favourable conditions for development occurring in 1916 ; there are grounds for hoping that next year will show an improvement, as the laboratory examination of the mulberry branches from the different parts of Piedmont has shown the invariable presence of the *Prospaltella* ;

3) this latter, while making a strong attack on the *Diaspis*, can never destroy it completely, nevertheless it is undeniable that the *Prospaltella* has rendered and will continue to render, the greatest service to mulberry cultivation ;

4) the mulberry trees found to be most often infected, even in zones

(1) See also B. June 1916, No. 707.

less severely attacked by the *Diaspis*, are those of bushy growth, with big branches in neglected condition ; on these same trees the older branches and those covered with lichen are the worst attacked, the reason being that the *Diaspis* finds conditions favourable to development while the *Prospaltella* finds difficulty in depositing its eggs. The farmer should, therefore, keep his mulberries clean by careful pruning at close intervals or by cutting the branches back every two or three years ;

5) artificial dissemination of the *Prospaltella* has been recognised as necessary in various localities of several provinces ;

6) notwithstanding that, owing to the conditions favourable to development, the *Diaspis* was present everywhere in very considerable numbers, the mulberries still gave a good crop of leaves. This is due to the fact that, nearly everywhere, the majority of female scale-insects contained individuals of *Prospaltella* ; in the localities (Stupinigi, Carmagnola, borders of the Dora Riparia, Saluggia) where in previous years the mulberries had been improved or almost entirely freed of the pest by means of the *Prospaltella*, in 1916 the *Diaspis* infection was restricted, this proves that the *Prospaltella*, properly distributed, had opposed excessive development of the scale ;

7) *Chilocorus bipustulatus* proved to be very effective in 1916, thus, aiding the action of the *Prospaltella*.

#### 692 - *Contarinia tritici*, a Dipteron Injurious to Wheat and Barley in Sweden.

— 1) AKERMAN, A., in *Sveriges Utsädejörensings Tidskrift*, Year XXVII, Part I, pp. 24-33

2) TEDIN, HANS, *Idem*, pp. 34-42. Malmö, 1917.

1. — During the summer of 1916, the larvae of *Contarinia tritici* did considerable damage to the different varieties of wheat cultivated at Svalöf. The dipteron deposits its eggs in the flowers of wheat and other cereals immediately after they have come into ear. The damage so produced varies from 5 to 10 % of the yield of grain and, in exceptional cases, may even exceed 60 %, as actually occurred on a farm at Allerum (Scania). The varieties attacked were all bearded ; careful examination of the crops, however, does not permit of the conclusion that the beardless varieties are less subject to attack by *Contarinia*. From this point of view a much more important factor is earliness : the varieties which had suffered most, viz. "Svenskt Sammel" (33.5 % of the yield of grain), "o 823 Pudel × Sv. Sammel" (15.5 %), "Thule II" (18 %), had earred on the following respective dates, 27th., 28th., and 29th. June ; the varieties which suffered least, viz. "Smaahvede × Sol" (2.2 %) "Fylgia" (2.9 %), "o 865 Smaahvede × Extra Sq. II" (2.4 %), came into ear some days later, from the 1st. to 3rd. July).

2. — TEDIN has obtained exactly similar results in an investigation of the damage done by the larvae of *Contarinia* in barley fields at Svalöf and other parts of Sweden. In this case also it was the earliest varieties that suffered the most from the larvae. This does not mean that the late varieties have a higher specific resistance ; the phenomenon is simply due to the fact that the females of *Contarinia* are more numerous in June than in the following season ; in other conditions of temperature and moisture (annual variations) exactly the opposite state of affairs might occur.

INSECTS  
INJURIOUS  
TO VARIOUS  
CROPS



693 - *Coeliodes fuliginosus*, a Coleopteron Injurious to the Poppy, in Austria.

— RANNINGER, RUDOLF, in *Zeitschrift für angewandte Entomologie*, Vol. 3, Part 3, pp. 383-387. Berlin, December, 1916.

Very little is known about the Coleopter *Coeliodes fuliginosus* Marsh., from the biological point of view nor do we possess any knowledge of practical methods of control. As a result of numerous experiments, the writer is now able to supply some useful information.

He has noticed that, at the end of May and beginning of June, numerous plants in a plantation of poppies had turned yellow and subsequently died. When the plants were pulled up the larva of the above Coleopter was found on the roots; this latter is white with a brown head, legless, and 3-4 mms. long; microscopical examination shows the back to be covered with fine hairs. The larva gnaws the root and hollows out either round holes or open galleries 1 - 1.5 mms. in depth; it is generally found on the upper half of the root, sometimes down to a depth of 8 cms. beneath the soil. One plant does not usually harbour more than a single larva; occasionally two occur and rarely three. According to the writer, 60% of the plants harbour one larva, 38 % harbour two and 2 % contain three larvae.

The plants harbouring the larvae show a blackening of the roots from top to bottom, the leaves then turn yellow and later brown in the same way and eventually die.

At the beginning of July, the larvae were very scarce, there was nothing to be seen beyond the damage caused by them; the last larva was found on July 22. After the larvae have disappeared, the holes or galleries on the roots close up.

The adult insect devours the young leaves of newly thinned poppies. The plant shrivels and the plantation becomes undesirably thin.

All the strains of poppy examined by the writer were not similarly attacked by the insect which apparently prefers young and juicy plants.

The Coleopter disappears relatively early so the damage caused is not great. The question as to the possibility of procuring immune strains is now being investigated.

According to the Station for Plant Diseases at Vienna, to which the writer submitted some specimens, there is only one generation in the year. The larva pupates in July, the perfect insect appearing 4 weeks later (late August to early September); the adult lives on various plants and hibernates in the soil, which it quits again in April.

As regards control, farmers have so far been content with pulling up and burning the plants considered to be attacked. As, however, it is almost impossible to distinguish those which harbour larvae from those which do not, the writer recommends the abandonment of this method. Nor is autumn ploughing to be recommended. Mineral fertilisers may be useful, however, by strengthening the plants. Prevention is best, though, and the writer recommends the following measures:

- 1) The poppies should be planted sufficiently widely apart to allow for proper developments.

- 2) By giving a dressing with Chili saltpetre or nitrate of lime, either



when thinning or immediately beforehand, the plant makes such strong growth that the attack of the insect remains without effect, calcium cyanamide or sulphate of ammonia can also be given; an application of potash- (wood ash) is equally good and strengthens the plant well.

3) The crop preceding the poppy should be well manured with farm-yard manure, but the poppy itself never.

4) The poppy fields should be kept properly clean of weeds and the plants hilled up, it is specially important to pull up the weeds at least once (after the plants are above ground and the rows are visible), to harrow the fields twice (once before pulling up the weeds, and again after thinning), and to hill up the plants once (after the appearance of the first branches);

5) sowing should be carried out in good time in the spring.

694 - *Phytomyza flavicornis*, a Dipteron Injurious to the Milan Cabbage, in Lombardy. — DEL VECCHIO, C., in *Natura*, Vol. VIII, January to April, pp. 75-77, figs. 2, Milan, 1917.

During September, 1915, in the experimental field of the Royal Higher School of Agriculture of Milan, situated at Sesto S. Giovanni (Monza), a large proportion of the Milan cabbages of a big plantation (sown July of the same year) had their large reddish or yellow outer leaves and the small inner leaves almost entirely atrophied. Examination showed the roots of all to be attacked by the larva of a Dipteron which had only injured the outer portions.

During the second half of October, the larvae pupated in the soil. In the summer of 1916 the pupae collected had become perfect insects and the fly was identified by Prof. BEZZI as *Phytomyza flavicornis* Fall.

In the same field, the writer found several roots badly damaged by another Dipteron, *Chortophila brassicae* Bouché and frequently saw *Aphis brassicae* on the leaves of some of the plants.

The whole of the Milan cabbages, however without exception, were attacked by *Phyt. flavicornis*.

695 - *Aleurodicus destructor* a Rhyncote Pest of the Coconut, in the Philippines (1). — ZIMMER, J. T., in *The Philippine Agricultural Review*, Vol. IX, No. 4, p. 276. Manila 1916.

In June 1916, in the province of Zamboanga (Dept. of Mindanao and Sulu), an insect was observed upon the coconut palm which was destroying a considerable part of the foliage and immature fruit.

The insect was identified as *Aleurodicus destructor* Quaintance, a somewhat rare Rhyncote, or one at any rate rarely recorded as injurious to the coconut. So far as is known, it is confined to the Philippines where the type species were collected in 1911 (Eastern Negros). Two years after the first record i. e. in 1913, it was observed in the Province of Misamis.

(1) See B., June 1912, No. 992.

696 - *Rhynchophorus ferrugineus*, a Coleopteron Injurious to the Coconut and other Palms in Ceylon. — HENRY, G. M. in *The Tropical Agriculturist, Journal of the Ceylon Agricultural Society*, Vol. XLV:1, No. 4, pp. 218-219, 1 plate. Peradeniya, 1917.

*Rhynchophorus ferrugineus*, the coconut red weevil, is common throughout Ceylon, particularly wherever the coconut is grown. It probably attacks other palms, such as *Caryota urens* ("Kitul") and *Areca Catechu*, but *Cocos nucifera* seems to be the favourite host. It has been noticed that freshly cut stems of *C. urens* have a strong attraction for this coleopter.

The adult insect, apparently, does no damage. The eggs are deposited in any wounds which may happen to occur on the stem of the palm, especially where the sap has fermented. The holes bored in the plant by another coleopter, *Oryctes rhinoceros*, are especially chosen by the *Rhynchophorus* to lay its eggs in. Immediately it has hatched the larva begins to burrow out the stem.

The life of the larva is probably a long one. Eventually it forms a cocoon and pupates within its own galleries, emerging after a period, the length of which is unknown.

The whole of the interior portion of the stem is often converted into a sort of soft pulp in which the larvae live and bore galleries in all directions. When this mass ferments it attracts other individuals of *Rhynchophorus* which lay eggs in their turn, in such a way that the combined action of all these insects quickly causes the death of the palm. Often there is no external evidence of attack, but on approaching the stem the presence of the larvae may be detected by the noise they make while piercing their galleries within.

So far no parasites or other insect enemies of *Rhynchophorus ferrugineus* have been found in Ceylon. The usual method of control is to remove all the infected portions of the plant with the contained larvae and to fill up the cavities so formed with tarred fibre. Experiments were made by injecting carbon bisulphide into the galleries but without sufficient effect, besides, it would be impossible to procure the requisite quantity of carbon bisulphide in Ceylon. It seems that good results should be obtained by trapping the adults with pieces of fermented stem of *C. urens*. The chief thing, however, is to keep the coconut plantations clean by removing and burning dead palms and by picking up from the ground all dead pieces of stem. Care should be taken to avoid damaging in any way the surface of the palm stems.

697 - Observations on the Vine Phylloxera in Bulgaria. — POPOFF, METHODIE and JOAKIMOFF, DIMITER, in *Zeitschrift für angewandte Entomologie*, Vol. 3, Part 3, pp. 367-382. Berlin, December 1916.

The writers state that, in Bulgaria, vines cultivated around dwellings and climbing upon trees, walls and other supports are much more resistant to phylloxera than vines pruned and cultivated in the open. This method of cultivation is known as "asmas" and occurs throughout Bulgaria.

The vines are from 4-5 metres apart, the soil is never worked; as the roots of the vines sometimes encounter roads, pathways or walls, they are



obliged to penetrate deep into the soil where they develop well, pruning being restricted to superfluous shoots. In this way vines are obtained resembling trees, with exceedingly well developed crown and roots, with the main trunk 15-20 cms. in diameter and with a shade area of 25-30 square meters; they often live for 100 years.

In every Bulgarian town and village vines cultivated "en asmas" are completely resistant to phylloxera, notwithstanding their European origin. On the other hand, pruned vines near the "asmas" are mostly attacked by the insect.

This immunity is not a character inherent in the variety but is due to the method of cultivation which is very unfavourable to the phylloxera for the following reasons:

1) in the case of vines with a deep and strongly developed root system where the radicolous insects can only live on the upper roots, the lower roots are sufficient to support the more or less normal life of a plant;

2) entrance of the gallicolous insects into the soil is more difficult when the ground is not periodically worked; working of the soil enormously favours the migration of the phylloxera;

3) by limiting pruning to the minimum, branches and leaves are formed which are very resistant to phylloxera.

In conclusion, the writers recommend the abandonment of present methods of cultivation (close planting, working the soil, pruning) where circumstances allow of the method above described. If it is wished to obtain vines resistant to phylloxera, they must be allowed to develop in tree form. Where manuring is necessary it should be effected before the phylloxera have begun to migrate and followed subsequently by a thorough pounding of the earth in order to prevent the insect from effecting an entry.

698 - *Clytus (Plagionotus) arcuatus*, a Coleopteron Injurious to the Oak, in Germany. — ESCHERICH, K., in *Zeitschrift für angewandte Entomologie*, Vol. 3, Part 3, pp. 388-397. Berlin, December 1916.

For some time past the timber merchants of the Palatinate have been complaining of the damage done to oaks by insects. In May, 1916, the writer accompanied by the forester FRANTZ, paid a visit to the oak woods in question in order to examine and assess the damage caused in this way.

It was observed in a saw-mill of the Dahn forest district that the oak-trees felled in 1915 and stored in front of the building were badly attacked by an insect which was identified later as *Clytus arcuatus* L. It had bored long galleries beneath the bark which contained either larvae of different sizes or pupae. In the trunks of trees felled in 1916 the insect could not be found.

Later on, a visit was made to a wheelwright in the same district who was complaining of the numerous galleries the insects had bored in his wood. The oak wood on the premises had been felled in 1914-15; it was completely invaded by the *Clytus*, larvae, pupae and adults. The trunks contained no other enemies, except a few which sheltered the cocoons of a big ichneumon unidentified by the writer.

At the time of a second visit in September to the same place, the trunks



felled in 1914-15 had all been worked and there only remained those of 1915-1916 which had only been brought to the saw-mills during the summer. They were all more or less attacked by the *Clytus*.

The majority of the larvae had attained one half or three quarters of their full size, some of them had already penetrated the inner portion of the trunk.

Introduction into the inner portion of the trunk is quite independent of the size of the larvae. The pupae and adults were completely absent.

According to the wheelwright, the trees stored in the shade were much less attacked than those stored in full sunlight. This corresponds with the fact that the *Clytus* is particularly fond of the light.

*Clytus arcuatus* thus especially attacks felled timber, but, according to ECKSTEIN and FRANTZ, it also destroys standing wood, especially that of poorly developed trees.

*Cl. arcuatus* is one of the most terrible enemies of oaks in the Palatinate where its appearance is an absolute calamity. Its rapid increase in numbers is due principally to the fact that, in the Palatinate, the cut timber usually remains lying about for a long time, which favours the hatching of the larvae.

The natural enemies of *Cl. arcuatus* not being very numerous, too much importance should not be attached to them. Besides the ichneumon already mentioned, the woodpecker devours the insect.

In order to avoid damage, the following points should be observed :

- a) remove sickly trees from the plantation ;
- b) remove trunks immediately after felling (end of April at latest), or, if that is impossible, store the trunks in the shade.

The writer recommends making a trial of whitewashing the felled trunks in order to prevent the insect from ovipositing. Removal of the bark is dear and injurious to the wood.

Study of the life-cycle of *Clytus arcuatus* is required.

INTERNATIONAL INSTITUTE OF AGRICULTURE  
BUREAU OF AGRICULTURAL INTELLIGENCE AND PLANT DISEASES

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OF THE SCIENCE  
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The Bureau assumes no responsibility with regard to the opinions and the results of experiments outlined in the Bulletin.

The Editor's notes are marked (Ed.).

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FIRST PART.  
ORIGINAL ARTICLES

**Cattle Breeding in the Argentine Republic at the Present Day**

by

GAETANO MARTINOLI

*Professor of Zootechny, Director of the Zootechnical Institute of the Agricultural  
and Veterinary Faculty of the National University of Buenos Aires.*

**NUMBERS OF CATTLE.** — The 1908 census showed there were 29 124 336 cattle in the Argentine. Later, the number of head of cattle was calculated by means of the available statistical data ; this showed that, in 1913, there were 30 706 447 animals. The results of the last census, which should appear shortly, are awaited with interest ; it will then be possible to judge whether, as has been asserted, the stock of cattle has been notably reduced by mortality due to years of drought, floods, epidemics, and, above all, to the slaughter of an excessive number of in-calf cows and of animals intended for exportation.

**HISTORICAL DATA.** — It is questionable whether there still exists a limited number of " pre-Columbian " horses (1) (i. e. horses existing in the country before the discovery of America by COLUMBUS), which may have transmitted their characters to certain animals of the " criolla " (Creole) breed. There is no ground for any such supposition with regard to the " criollos " cattle. It is, indeed, certain that there were no cattle in America when it was discovered, and that the Argentine cattle are descended from the Andalusian breed imported by the Spaniards at the beginning of their conquest. The cattle, like the horses, allowed to run wild, found in the pampas conditions generally favourable to their multiplication, increased rapidly, and filled the country. On the other hand, their increase was facilitated by the Spanish laws which, for a long time, hindered or even prevented completely, the free exportation of these animals and their

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(1) see in *B.*, June 1917, p. 819, the article by the same author on *Horse breeding in the Argentine Republic at the present day.*

products, so that, owing to the smallness of the population, it was only possible to use them to a limited extent.

With time, the "criolla" race acquired distinct characters and, above all, a distinct development according to the environmental conditions in which it found itself in the different districts of the country, temperate or sub-tropical, flat or mountainous. In any case it may be said, generally speaking, that it excelled neither in the production of meat nor in that of milk, but at times only, in capacity for work.

The characteristics of the "criollos" cattle may be summarised as follows:

Animals symmetrical or otherwise, late in coming to maturity. Ample bone; head rather small; forehead broad, horns usually lyre-shaped, long, not very thick. The neck is short with well-marked dewlap. Upper line of trunk curved; croup short, oblique, angular; tail long, inserted fairly high and ending in a thick switch. Barrel well developed. Muscles of the upper parts of the limbs slightly developed. Coat, light or dark fawn with patches of colour. Muzzle, dark.

So long as local demands and requirements were limited, so long as the export trade consisted only in the sale of skins, suet and "tasajo" (salt meat), the "criolla" race did good service, and no necessity to replace it by others was felt. The position changed when the exportation, first of live animals, then of frozen meat, was started. For the manufacture of "tasajo" which for many years, was the only form in which meat was exported from Argentine, "novillos criollos" (creole steers) were used, chiefly because their relatively small amount of fat facilitated the preparation of the product. When, however, live animals began to be sent to England, the necessity was realised of producing material of a higher quality, which would meet the requirements of the new consumers and at the same time, by reason of its increased yield and earlier maturity, allow a greater interest to be made on the capital invested in this industry.

During the second half of the 19th century, therefore, breeding cattle of various British races began to be imported, their numbers increasing yearly. During the 15 years from 1900 to 1914 the following breeds were imported:

Breed	Number of animals	Breed	Number of animals
Shorthorn	10 650	Flemish	66
Hereford	483	Schwyz	3
Aberdeen Angus	468	Dutch	113
Red Polled	148	Dexter Kerry	26
Red Shorthorn	125	Other breeds*	272
Jersey	106		
		<b>Total</b>	<b>12 460</b>

\* This includes the Sussex, Devon, Guernsey, Charolaise, Norman, Ayrshire, Galloway and Fribourg breeds.

The great preponderance of the Shorthorn breed over all others, including the Hereford and Aberdeen Angus breeds which, although almost equal in number, are yet much below the Shorthorn, is immediately no-



ticed. It is also remarkable that the greater part of the breeding stock comes from the United Kingdom, a fact which is dependant, not only on the principal import and export tendencies, but also on special provisions with regard to the introduction of breeding cattle of non-British origin. On many occasions these provisions have been temporarily suspended — during international exhibitions, etc. — and now they are being partly withdrawn.

The imported cattle were partly bred pure on the “cabañas” (stock farms) of the Argentine, and others, with their progeny, were used for progressive crossing with the “criolla” breed. The most perfect specimens of these crosses are the so-called “puros por cruza” animals, which show no trace of the breed subjected to the crossing. There is a whole series of intermediary grades between these animals and pure “criollos”.

Tables I and II give data on the number of pure-bred and cross-bred cattle in the Argentine.

TABLE I. — *Cattle entered in the Argentine Herd Book up to the present day and from the 1st October 1915 to the 1st October 1916.*

Breed	Animals entered up to the present day			Animals entered from the 1st. Oct. 1915 to the 1st. Oct., 1916					
	Male	Female	Total	Imported		Born in the country		Total	
				Male	Female	Male	Female		
Shorthorn . . . . .	45 331	48 502	93 833	402	96	4 069	4 244	8 811	
Hereford . . . . .	8 613	10 794	19 407	13	—	554	566	1 123	
Aberdeen Angus . . . . .	4 009	4 325	8 334	32	11	583	558	1 184	
Red Shorthorn . . . . .	138	196	334	2	—	6	7	15	
Red Polled . . . . .	99	112	211	—	—	13	12	25	
Devon . . . . .	15	20	35	—	—	1	2	3	
Jersey . . . . .	35	42	78	2	5	10	9	26	
Flemish . . . . .	134	465	599	—	—	30	36	66	
Total . . . . .	58 374	64 457	122 831	431	112	5 266	5 424	11 253	

TABLE II. — *Different breeds of pure-bred and cross-bred cattle in the principal breeding provinces of the Argentine, in 1908.*

Breeds	Province of Buenos-Aires	Province of Santa Fé	Province of Entre Rios	Province of Corrientes	Province of Córdoba	Pampa	Whole of the Argentine
Shorthorn . . . . .	4 596 067	6,6 865	914 140	340 768	445 478	150 278	7 385 880
Hereford . . . . .	185 635	39 355	102 156	156 171	45 075	4 782	553 555
Aberdeen Angus . . . . .	58 523	3 161	44 944	5 900	5 111	1 125	125 829
Jersey . . . . .	1 146	859	—	14	—	—	2 076
Red Polled . . . . .	1 702	—	—	—	—	—	1 702
Dutch . . . . .	12 871	4 002	671	208	2 930	—	21 164
Flemish . . . . .	2 732	13	—	1	—	—	2 844
Swiss . . . . .	1 828	570	—	—	—	—	2 401

TABLE III. — Price (in paper pesos \*) of breeding-stock sold at the exhibition of the " *Sociedad Rural Argentina* " in August, 1916.

Breed		Animals entered	Animals sold	Price		
				minimum	maximum	average
Shorthorn.	" a galpón " 763 .	Males 681	583	900 pesos	50 000 pesos	3 609 pesos
		Females 82	26	900	3 700	1 588
	" palenque " 213 .	Males 203	170	700	4 200	1 788
		Females 10	5	950	1 150	1 110
Hereford . .	" a galpón " 116 .	Males 99	48	450	12 000	1 904
		Females 17	4	250	600	425
	" palenque " 15 .	Males	9	850	1 600	1 255
Aberdeen Angus	" a galpón " 86 .	Males 63	41	800	3 500	1 496
		Females 23	—	—	1 600	—
	" palenque " 10 .	Males	10	1 050	1 600	1 320
Red polled . . . . .	2 .	Males	—	—	—	—
Flemish . . . . .	7 .	Males	5	1 100	1 900	1 650
Jersey . . . . .	5 .	Males 2	1	700	700	700
		Females 3	—	—	—	—
Fribourg . . . . .	8 .	Males	1	600	600	600
Dutch . . . . .	26 .	Males 21	8	670	2 400	1 027
		Females 5	5	340	400	366
Dexter Kerry . . . . .	2 .	Males 1	—	—	—	—
		Female 1	—	—	—	—
Norman. . . . .	2 .	Males	—	—	—	—

Profit on sales: 2 653 200 pesos.

\* 1 paper peso of the Argentine Republic = 1 s. 9 d.

According to Table II, the majority of the improved cattle are in the provinces of Buenos-Aires, Entre Ríos, Santa Fé, Corrientes, Córdoba and in the Pampa. On the other hand, in the provinces of the north, those of the Andes and those of the south, the work of improving cattle is still in its infancy, and the " criolla " breed predominates.

RAISING. — With the exception of the " cabañas " bulls, the cattle are kept on open pasture land ; both the animals kept in the " potreros " (enclosures) and those left free, live almost exclusively on natural pasture or alfalfa ; it is very rarely they are fattened by being fed maize, ensilaged fodder, bran, etc.

A tribute of admiration and respect must be paid to the Argentine " cabañeros " (breeders) in recognition of their patriotism. The mission of the " cabañero " consists in importing the best breeding stock, for which

he sometimes pays exceedingly high prices, and breeding them on his own farms in order to sell their progeny and supply the pure-bred animals which are in constant demand for crossing. The sale price of this breeding stock is, in most cases, undoubtedly high, yet the expenses incurred in maintaining the "cabañas" are enormous, so that the profit made on the invested capital is often very low, and more than one "cabañero" has been obliged to retire from the trade. It is for this reason that the word "mission" has been intentionally used in connection with the work of these well-deserving citizens.

VALUE OF BREEDING STOCK. — Table III gives an idea of the prices realised by breeding cattle sold at the Exhibition of the "Sociedad Rural Argentina" in August, 1916.

The sum of 50 000 pesos is not the highest paid for a Shorthorn bull, for "Americus", the champion of the 1913 Exhibition, was sold for 80 000 pesos.

DISTRIBUTION OF THE PRINCIPAL BREEDING CATTLE. — At the present day the Argentine possesses a large stock of Shorthorn breeding cattle of both sexes, which will bear comparison with the best of those in the United Kingdom; if desired, the Argentine could be completely independent where this breed is concerned. Hereford and Aberdeen Angus are also well represented, though they have not yet, in every case, reached the same degree of excellence as the Shorthorns. For practical purposes, it is these three breeds which must be considered when studying the present state of the improvement of Argentine cattle.

Shorthorns predominate in the richest and most temperate districts of the Argentine, and are found on the best "pastos tiernos" (tender pasture) and "alfalfares" (alfalfa fields). Herefords and Aberdeen Angus are bred in the warmer or colder districts which produce pasture which is both less abundant and less good.

The marked predominance of the Shorthorn breed over all others may be explained by the fact that, hitherto, the export trade has been almost exclusively transacted in England. We believe, nevertheless, (and our opinion is shared by many breeders) that if, after the end of the war, new markets open and develop on the European Continent, they will prefer the more tasty and better marbled meat of the Hereford and Aberdeen Angus cross-breeds, and this demand will cause a great increase in their production.

CARCASE WEIGHTS OF THE 3 PRINCIPAL BRITISH BREEDS. — Table IV gives the averages obtained by the LA PLATA COLD STORAGE COMPANY from 1142 cattle from exhibitions of fat stock between 1910 and 1914.

Steers intended for cold storage do not, of course, normally weigh as much as the animals mentioned in Table IV, a weight of from 600 to 650 kg. at 3 years of age being considered satisfactory.

OBSTACLES TO THE IMPROVEMENT OF THE "CRIOLLA" RACE. — A serious problem, the rational solution of which will have a large influence on the future of cattle breeding in practically the whole of northern Argentina, is the improvement of the "criollo" cattle.



TABLE IV. — *Average results obtained by the LA PLATA COLD STORAGE COMPANY from the slaughter of 1142 fat cattle of the Shorthorn, Hereford and Aberdeen Angus breeds.*

Categories and produce	Shorthorn	Hereford	Aberdeen Angus
<i>Milk teeth:</i>			
Live weight . . . . .	518 kg (1)	—	479 kg
Net weight . . . . .	324 kg	—	296 kg
Net weight in % of live weight . . . . .	62.3 %	—	61.9 %
Fat . . . . .	43.6 kg	—	33.0 kg
Skin . . . . .	26.8 kg	—	34.4 kg
<i>2 teeth:</i>			
Live weight . . . . .	611 kg	586 kg	—
Net weight . . . . .	396 kg	387 kg	—
Net weight in % of live weight . . . . .	64.8 %	65.4 %	—
Fat . . . . .	51.7 kg	50.4 kg	—
Skin . . . . .	39.5 kg	35.0 kg	—
<i>4 teeth:</i>			
Live weight . . . . .	644 kg	609 kg	640 kg
Net weight . . . . .	421 kg	404 kg	429 kg
Net weight in % of live weight . . . . .	65.2 %	66.3 %	66.3 %
Fat . . . . .	50.4 kg	49.5 kg	57.2 kg
Skin . . . . .	31.0 kg	34.0 kg	29.5 kg
<i>6 teeth:</i>			
Live weight . . . . .	773 kg	754 kg	724 kg
Net weight . . . . .	510 kg	512 kg	474 kg
Net weight in % of live weight . . . . .	66.0 %	67.8 %	65.4 %
Fat . . . . .	59.5 kg	58.0 kg	57.0 kg
Skin . . . . .	34.5 kg	37.7 kg	32.7 kg
<i>Full mouth:</i>			
Live weight . . . . .	851 kg	851 kg	—
Net weight . . . . .	563 kg	528 kg	—
Net weight in % of live weight . . . . .	66.1 %	65.1 %	—
Fat . . . . .	62.7 kg	58.6 kg	—
Skin . . . . .	36.0 kg	43.1 kg	—
(1) 1 kg = 2.2 lbs.			(Ed.)

There are two important factors which greatly hinder such improvement — “tristeza” (bovine piroplasmosis), and the climate.

As is known, “tristeza” is an disease caused by a parasitic haematozoan, *Piroplasma bigeminum*, which lives in the red blood corpuscles. This disease, also called “Texas fever”, “red-water”, “bovine malaria” is, in some cases, sporadic and not very dangerous, but in others it is enzootic, and as in the Argentine, causes great loss to breeders. In the infected districts, the “criollos” animals, and those which have been but slightly crossed, enjoy a natural relative immunity, but improved breeding stock when introduced are very susceptible to the fever, and from 50 to 90 % of

them die. The disease is carried from sick to healthy animals by a tick (1), the "garrapata" (*Boophilus microplus* Can.), which thrives particularly in the hot districts, and in the "pastos fuertes", or natural pasture lands of hard grasses of low food value.

In order to prevent the spread of "tristeza", the Argentine Government divided the country into 3 districts: — infected zone; intermediate zone; immune zone. To the first belongs nearly all the north of the country, the second includes the southern parts of the provinces of Córdoba, Santa Fé and Entre Ríos; the third includes the parts furthest south of the provinces of Córdoba and Santa Fé and all the rest of the Republic. Before animals may pass from the infected to the immune districts, they must be disinfected in the official anti-parasite "bañaderos", erected on the borders of the 3 zones and must submit to precautions taken by the sanitary police. No satisfactory treatment has yet been discovered for "tristeza" but attempts are made to fight it by burning the "pastos fuertes" from time to time, by extending artificial meadow land and by immunising the cattle by vaccination with a weak virus.

On the other hand, the climate is also a negative factor detrimental to the improvement of cattle in the north of the Argentine. It must not be forgotten that the pure-bred bulls which are imported nearly always come from temperate districts rich in good pasture-land. These animals, suddenly transferred to semi-tropical districts and given pasture of inferior quality, suffer greatly, waste away and thus very easily contract the dreaded "tristeza".

If, therefore, the "criolla" breed is to be effectively improved, not only must the measures already mentioned be applied and made yet more strict, but the living conditions of the imported breeding-stock must be improved, so that they may be acclimatised gradually, not suddenly. From this point of view the establishment of a series of breeding stations would be of great importance. These would be placed at strategical distances apart, so to speak, and would be used for the successive breeding and production of breeding stock intended for the north of the country. By these means the cattle, when they reach their destination, will have largely overcome the crisis of adaptation to the new climatic and environmental conditions, and with the help of inoculations and other suitable methods, they will be much better able to resist the attacks of "tristeza" than they are at the present day.

While travelling in the north of the country we visited breeding farms where private individuals had followed this course on their own account, and had obtained very satisfactory results.

Besides the measures already mentioned, there is no doubt that others might be adopted to the same end. In certain parts of the province of Salta, the Chaco, etc. there are well-developed "criollos" cattle which a mere process of selection is capable of improving. In this case there would be the great advantage of using animals already completely acclimatised.

(1) See B. June, 1911, No. 1805; B. May 1912, No. 810; B. February 1913, No. 145; B. November, 1914, No. 1019. (Ed.)



Moreover, there is no reason why Herefords and Aberdeen Angus should be the only breeds used for improving the "criolla" race by crossing. We have excellent groups of Devons, and Red Polled cattle might certainly be tried, as well as other good outdoor non-English breeds, such as the Romagnola, Charolaise, etc. The breeding possibilities of the north are, therefore, immense. If there be taken into account the great water-ways which allow easy communications with the chief ports of the Argentine, and the fact that, in many districts, there are two maize crops a year, it is easy to foretell the results which may be obtained when the population has increased and the methods of cultivation and breeding have been improved.

MEAT TRADE. — The exportation of live cattle and "tasajo", which, originally, was of much greater importance than that of frozen and chilled meat, was soon exceeded by this latter, as may be seen from Table V.

TABLE V. — *Exportation of live cattle, of meat and its derivatives, from 1883 to 1914 (in metric tons).*

Year	Live cattle	Frozen meat	"Tasajo"	Meat extracts and preserves	Total
1883. . . . .	—	28	—	—	28
1896. . . . .	382 539	9 535	371 700	101 800	865 394
1900. . . . .	150 550	66 571	268 000	61 400	540 521
1901. . . . .	119 189	126 073	327 800	75 200	648 262
1902. . . . .	118 303	207 553	330 600	124 300	780 756
1903. . . . .	181 860	254 971	152 600	116 300	705 731
1904. . . . .	129 275	304 093	159 900	83 200	676 468
1905. . . . .	262 681	483 985	283 200	127 900	1 157 766
1906. . . . .	71 106	500 027	106 800	181 900	859 833
1907. . . . .	74 841	444 132	197 300	202 600	918 873
1908. . . . .	60 916	573 946	92 100	155 400	882 362
1909. . . . .	132 450	641 803	154 600	185 100	1 113 953
1910. . . . .	89 733	724 905	156 700	259 100	1 220 438
1911. . . . .	184 112	934 425	139 200	246 800	1 504 537
1912. . . . .	261 416	1 030 091	129 800	253 000	1 674 907
1913. . . . .	224 911	1 023 186	24 000	237 200	1 509 297
1914. . . . .	115 556	1 100 079	2 500	153 000	1 371 135

The live cattle are chiefly sent to the markets of the South American Republics (Uruguay, Chili, Brazil, Bolivia, Paraguay), whereas the "tasajo" is chiefly exported to Cuba and Brazil, and the frozen meat to the United Kingdom.

Below is given the total number of cattle killed in the abattoirs, cold-storage slaughter-houses and "saladeros" (salt meat factories) during the years 1904, 1910 and 1914.

Year	Total number of cattle	Calves	Steers	Cows	
				Number	% of total
1904 . . . . .	1 456 632	108 454	988 811	359 367	26.6
1910 . . . . .	2 685 270	301 095	1 584 495	799 680	23.5
1914 . . . . .	3 211 485	135 573	2 289 804	786 108	25.5



TABLE VI. — *Sale price of cattle at the Buenos-Aires abattoirs from 1888 to 1911 (in paper pesos).*

Category	1888	1890	1898	1904	1907	1909	1913	1915	1916
<i>Axen:</i>									
special. . . . .	23-54	32-44	59-63	70-75	—	90-100	160-170	220-270	180-200
fat. . . . .	—	—	—	60-65	68-78	85-95	140-150	180-200	160-170
fat meat. . . . .	—	—	—	52-56	60-66	70-80	120-130	170-180	130-140
good meat. . . . .	—	—	39-42	48-50	—	60-70	100-110	120-150	110-120
<i>Crossbred Steers:</i>									
special. . . . .	38-54	32-52	76-81	76-80	73-82	100-115	150-170	210-240	190-200
fat. . . . .	15-38	16-28	45-54	60-65	68-72	90-95	130-150	170-190	160-180
fat meat. . . . .	10-15	8-20	—	54-57	53-58	66-70	115-120	150-160	140-150
good meat. . . . .	8-10	16	—	50-52	48-52	60-65	90-100	85-140	120-130
<i>"Criollos" Steers:</i>									
fat. . . . .	12-23	—	43-54	54-58	56-60	60-65	110-120	150-170	140-160
<i>Crossbred cows:</i>									
special. . . . .	38-54	—	40-50	60-65	58-63	80-90	120-130	150-160	150-160
fat. . . . .	15-38	20-28	—	48-54	50-58	70-75	95-100	120-130	130-140
fat meat. . . . .	10-15	16-20	31-36	38-40	38-43	50-55	85-90	110-120	110-120
good meat. . . . .	8-10	16	23-29	32-34	30-36	40-50	75-80	95-105	90-100
<i>"Criollos" cows:</i>									
fat. . . . .	—	—	—	40-45	38-44	50-55	80-90	110-120	100-110
good meat. . . . .	8-10	5-7	21-23	27-30	28-33	30-35	70-75	80-90	80-90
<i>Crossbred Heifers:</i>									
special. . . . .	—	—	—	36-40	40-46	40-50	100-110	120-130	120-130
fat. . . . .	—	—	—	—	34-38	35-40	95-100	110-120	105-115
fat meat. . . . .	—	—	—	24-28	28-33	28-33	80-85	90-100	85-95
<i>"Criollos" Heifers</i>									
fat. . . . .	—	—	—	—	—	—	70-75	90-100	80-85
fat meat. . . . .	—	—	—	—	—	—	50-55	70-80	60-70
<i>Calves:</i>									
special. . . . .	6-10	6-12	11-13	24-27	28-34	25-28	70-80	75-85	75-85
good. . . . .	—	—	—	18-20	22-26	20-22	55-60	65-70	60-70
<i>Milk Calves:</i>									
fat. . . . .	—	—	48	12-14	12-18	8-10	35-40	30-40	35-45
good. . . . .	3-5	—	—	8	8-10	—	20-30	20-25	20-30
medium. . . . .	—	—	—	—	5-10	—	10-15	10-15	10-15

Many more cows are killed in the abattoirs than in the "saladeros" and cold-storage slaughter-houses, as is shown by the average percentages for the period 1904-1914: Abattoirs, 47.7 %; "saladeros", 13.3 %; cold storage, 4.74 %.

Table VI shows the prices realised in the Buenos-Aires "mataderos"

(abattoirs) according to the class, sex and age of the animals in spring and summer of a series of years since 1888.

If the prices of 1888-1890 are compared with those of 1913 (before the war) an enormous difference is noticed, the figures of 1913 being sometimes ten times as great as those of 1888-1890. This has become still more marked since the war; thus, certain exceptional lots of steers have realised as much as 300 pesos per head.

#### PRODUCTION OF MILK AND ITS DERIVATIVES :

According to the 1908 census, 2 163 900 dairy cows were in milk in the Argentine; about 800 000 of these were of the Shorthorn breed.

The average milk yield per cow is relatively very low, barely exceeding 1000 litres per annum. There are, of course, farms which produce more, for there are cows capable of giving 20 litres of milk or more per day, but as a rule, the above-mentioned yield is obtained. This low production is due to many causes; foremost among these are the life in the open pasture lands (influence of changes of temperature, sun, wind, insects, etc.), lack of fodder reserves, lack of suitable morpho-physiological selection, etc.

It is true that there are other breeds more specialised in milk-production than the Shorthorn. Considering, however, the special local conditions, where the main object is invariably meat-production, and considering also that certain Shorthorn cows are capable of giving as much as 4000 litres of milk a year, there is no reason why the present conditions should not be improved. It would be possible to raise the milk yield to 2500-3000 litres per cow by adopting the following methods: the use of good bulls of dairy families; suitable selection of cows; more careful and more uniform feeding; shelter against climatic conditions.

Intensive individual production of large quantities of milk will only be possible in the Argentine in the far future, when an increased population will give rise to many small farms, capable of supplying varied and abundant food to a small number of animals kept, either on the mixed system (open pasture and shippens), or exclusively in shippens. At the present day, in most cases, dairy herds are kept by landed proprietors, who divide them into groups of 50 or 60 animals forming a "tambo", tended by a family, usually of Basque extraction. If, for each "tambo", a certain area of fodder destined to act as reserve food at critical times were cultivated and certain commodities were supplied for the animals, great progress would already be made. Unfortunately, except on rare occasions, the division of cows into small groups is seldom accompanied by any intensification of the conditions under which they are kept.

On the other hand, the high prices realised by animals for the butcher have given a new blow to the already tottering dairy industry, and the great drought of 1916 brought about a real crisis.

Nevertheless, we are convinced that it is only a question of time, and that the present stagnation will be followed by a period of great activity and prosperity.

All the district near the coast and the rivers presents conditions very favourable to the dairy industry; this also applies to the mountainous re-

TABLE VII. — *Production and number of establishments engaged in the dairy industry from 1903 to 1915.*

Year	Number of establishments				Production		
	Milk dairies	Butter dairies	Cheese dairies	Mixed dairies	Butter	Cheese	Casein
1903 . . . .	224	14	48	38	8 835 039 kg	1 087 997 kg	—
1905 . . . .	282	26	78	40	8 833 881	1 950 401	—
1907 . . . .	409	29	85	56	6 727 988	1 870 802	—
1909 . . . .	545	18	111	185	7 151 647	3 084 261	—
1911 . . . .	398	10	158	329	7 904 981	3 513 524	—
1912 . . . .	516	8	128	367	9 457 261	5 425 989	5 334 910 kg
1913 . . . .	462	9	131	323	10 197 752	5 689 421	6 729 341
1914 . . . .	502	21	299	470	8 834 572	6 779 397	4 729 341

TABLE VIII. — *Production, consumption, importation and exportation of butter and cheese from 1903 to 1915.*

Year	Production	Importation	Exportation	Total consumption	Per head consumption
Butter	1903 . . 8 835 039 kg	—	5 330 140 kg	3 504 899 kg	0.697 kg
	1905 . . 8 833 881	—	5 393 233	3 440 828	0.612
	1909 . . 7 151 647	—	3 992 724	3 158 913	0.404
	1911 . . 7 904 981	—	1 396 000	6 508 981	0.871
	1913 . . 10 197 752	—	3 784 000	6 413 752	0.802
	1915 . . 8 834 572	—	4 623 000	4 211 572	0.600
Cheese	1903 . . 1 087 998 kg	1 129 364 kg	3 869 kg	2 313 493 kg	0.460 kg
	1905 . . 1 950 401	1 920 790	2 452	3 868 739	0.612
	1909 . . 3 084 261	4 030 057	—	7 114 318	0.045
	1911 . . 3 512 524	4 919 437	518	8 432 443	1.129
	1913 . . 5 689 421	5 045 040	7 342	10 727 119	1.344

gions of Neuquén and Salta, while good results may also be obtained in the interior. In suitable districts attempts might be made to keep the European alpine types and increase the herds of Dutch cattle, which have given excellent results, because, like the Jersey breed, they may profitably be kept in the open.

In the south of the Argentine, Aberdeen Angus cows giving good milk yields (as much as 20 litres per day per animal) have been observed. This is of great interest in view of the suitability of this breed to open-air life and its capacity for meat production.

It is, of course, necessary that the Government, on its side, should faci-



litate the development of this industry by means of new roadways and railways, the reduction of tariff refrigerating cars, etc.

Table VII summarises the data concerning the production and total number of establishments engaged in the dairy industry from 1903 to 1915. Table VIII gives, for the same period, figures relating to the production, consumption, importation and exportation of butter and cheese.

Whereas the amount of butter made and its consumption per head have not suffered any important variations, the exportation of this product decreased greatly between 1909 and 1913.

On the other hand, the production and consumption of cheese have increased continuously, and the consumption per head has risen from 0.460 kg. in 1903 to 1.344 kg. in 1913.

At the present day the following varieties of cheese are manufactured in the Argentine: -- Cheddar, Cheshire, Dutch, Fontina, Grana, etc. These are all of excellent quality and there is no doubt that, before long, it will not only be possible to dispense with cheese imported from Europe, but even to export it in large quantities.

## SECOND PART. ABSTRACTS

### AGRICULTURAL INTELLIGENCE

#### GENERAL INFORMATION.

699 - **Agricultural and Economical Development of Venezuela.** — DUHAUT, in the *Bulletin de l'Office de Renseignements agricoles du Ministère de l'Agriculture de France*, Year 15, October-November, 1916, pp. 441-453. Paris, 1916.

Venezuela, which has an area of about 424 710 square miles, is bounded on the north by the Carribean Sea, on the north-east by the Gulf of Paria and the Atlantic Ocean, on the east by British Guiana, on the south by Brazil and on the west by Columbia. The length of the coast is more than 1366 miles. It is watered by the Orinoco and the tributaries of Lake Maracaibo.

It has a population of 2 800 000 inhabitants (6.59 per square mile), not including the Indians, of whom it is impossible to take a census. The official language is Spanish; the most generally spoken foreign language, French.

**DIVISION AND COST OF LAND:** — The law of July 4, 1912, divided the land into two categories themselves sub-divided into two classes: 1) 1st. and 2nd. class agricultural land; 2) 1st. and 2nd. class pasture land.

The distinction between the two categories depends on the conditions of irrigation, exposure, temperature and vegetation, on the proximity to means of communication, the coast or an important town.

Land	Sale price	Rent
1st. class agricultural land,	40 bolivares (1) and more .	$\left. \begin{array}{l} \text{per } 4 \text{ bolivares} \\ \text{hectare (2) } 1 \text{ bolivar} \end{array} \right\} \text{ per hectare}$
2nd. class agricultural land,	25 bolivares and more .	
1st. class pasture land,	2 000 bolivares and more .	$\left. \begin{array}{l} \text{per } 2\,500 \text{ } 100 \text{ boliv.} \\ \text{hectares } 75 \text{ } \text{,,} \end{array} \right\} \text{ per } 25 \text{ square km. (1)}$
2nd. class pasture land,	1 200 bolivares and more .	

(1) 1 bolivar = 9  $\frac{1}{2}$  d. at par, (2) 1 hectare = 2.47 acres. (3) 1 square km. = 0.381 square miles.

DEVELOPMENT  
OF  
AGRICULTURE  
IN DIFFERENT  
COUNTRIES

The conditions for purchasing large forest estates yielding natural products (gum, rubber, wood, etc.) are also fixed by law : — a minimum of 12.5 square km. and a maximum of 60 square km.

AGRICULTURAL DISTRICTS. — From an agricultural point of view Venezuela may be divided into 3 regions.

1) *Maritime region*, the true agricultural region (cocoa, coffee, sugarcane, banana, maize, vegetables, tobacco, and, in the higher land, wheat and vines) ;

2) *Breeding region*, in the plain of the Orinoco basin, occupying about  $\frac{1}{3}$  of the total area (cattle, horses, goats).

3) *Forest district*, in the south (rubber, balata, building wood, cabinet woods, plants yielding tannin and dyes, vanilla, sandal-wood, tonca-beans, corozos, oil-nuts, etc.).

Fibre plants are found in all 3 districts.

COMMUNICATIONS. — *Within the country*. — The Orinoco and its tributaries, navigable along the greater part of their length, form the chief natural inland means of communication. There are already a certain number of roads, and some railways. For the present these means of communication are sufficient.

*With abroad*. — Venezuela is in direct and regular communication with the United States, Central America, France, England, Holland, Spain, Italy and the islands of the West Indies though the steamship lines of these countries. Before the war it was also connected with Germany by the German lines. The 5 principal ports are : La Guaira, Puerto Cabello, Maracaibo, Carupano and Ciudad-Bolivar : this last port is on the Orinoco, about 186 miles from the mouth. The 6 secondary ports are : Cumana (Puerto-sucre), Guanta, Cristobal Colon, La Vela de Coro, Pampatar, the port of Margarita Island, and Barrancas, a river port on the Macareo branch of the Orinoco Delta.

AGRICULTURAL IMPORTS FROM EUROPE. — These only include agricultural and dairy produce, such as butter, cheese, wine, agricultural machines and implements, etc.

During the last 5 years before the war from 1909 to 1913 inclusive, and during the first 7 months of the war, the total imports of Venezuela reached a value of 455 816 015 *bolivares*, of which 294 278 481 *bolivares* represent imports from Europe.

#### *Details of imports from Europe.*

England	115 413 000	<i>boliv.</i>	of which	5 017 000	<i>boliv.</i>	represent	agricultural	products
Germany	74 606 000	"	"	3 730 000	"	"	"	"
France	40 328 000	"	"	3 800 000	"	"	"	"
Holland	32 232 000	"	"	2 303 000	"	"	"	"
Spain	20 401 000	"	"	4 750 000	"	"	"	"
Italy	14 651 000	"	"	2 930 000	"	"	"	"

The rest of the imports from Europe are divided amongst Austria, Belgium, Denmark and Portugal.



Wine forms  $\frac{4}{5}$  of the total agricultural exports from France ; the same applies to Spain and Italy.

England and Germany export chiefly agricultural implements.

AGRICULTURAL EXPORTS INTO EUROPE. — The total value of the Venezuelan exports from 1909 to July 1st. 1914 was 538 160 157 *bolivares* of which 412 856 649 *bolivares* were imported into Europe.

*Details of exports into Europe, (agricultural products and their derivatives).*

Imported into France. . . . .	203 179 000 <i>bolivares</i>
" " Germany. . . . .	97 807 000 "
" " England . . . . .	51 742 000 "
" " Spain . . . . .	32 046 000 "
" " Holland . . . . .	23 976 000 "
" " Italy . . . . .	6 490 000 "

SLIGHTLY DEVELOPED AND UNDEVELOPED RESOURCES. — Most of the products of the soil or the sub-soil of Venezuela are either not undeveloped or only slightly so. This is not due, as has been stated, either to lack of means of communication or to diseases of cattle.

These products may be divided into 2 groups : A) those which may be put to immediate use, and may satisfy the requirements of the present day or after the war ; B) those which cannot be put to use for some time, and which require a more or less lengthy preliminary period for their extraction, preparation, etc.

A. *Products which may be put to immediate use.* — 1) BREEDING STOCK  
Breeding stock are the most important of these products. Large companies might be formed for the improvement and working of the immense pasture-lands of the northern and western basin of the Orinoco in conjunction with the Venezuelan land-owners, who would willingly support such undertakings.

The Venezuelan cattle were imported from Andalusia by the Spanish conquerors. Breeding became important only after the War of Independence; it was started in 1823 with about 260 000 head of cattle. This is but a very small number, but it has increased greatly since then.

The breed, which in many ways, resembles the Portuguese "brava" breed, has never been modified by crossing : Its characteristics are : — height,  $3\frac{1}{2}$  to  $4\frac{1}{4}$  feet, length from 4 to 5 feet. head, medium ; coat, usually light (in bulls, darker, nearly mahogany); horns, medium, not very strong and rather short ; ribs, well-sprung ; back, slightly hollow towards loins ; weight, varying according to pasture (average weight from 913 to 924 lbs.).

The Caracas abattoirs are very well fitted up. The dressed weight has never been less than 50 % of the gross weight and may be as much as 55 %, or even 58 % in the case of the heaviest animals (1 100 lbs.).

There are no diseases of cattle in Venezuela, the reports of an epidemic disease are false, and were doubtless spread by foreign agents who feared competition with the large breeding companies they were attempting to establish.

The horses were also introduced into the country by the Spaniards. At the present day they number more than a million ; this takes into consideration the official figures of 1894, which gave 220 000 horses and 500 000 asses and mules.

The characteristics of the horses are : — head usually rather long, often slightly arched ; ears straight, medium ; neck average length, straight ; back slightly hollow ; sides a little slanting ; thighs fairly prominent ; sides rather flat ; stands ; fairly square ; hind legs set slightly in under body ; height from 11-3 to 14-2 hands ; coat usually chestnut, light or dark bay and, sometimes, dappled roan. The horses are quiet and courageous ; they can carry an average weight of from 210 to 220 lbs., and, in harness can draw about 550 lbs. ; they can cover an average distance of 22 miles.

The characteristics of the mule are : — head, rather big ; profile slightly convex ; ears long, slender, and straight ; length, between that of the horse and the ass, neck usually short and straight ; back slightly hollow ; vertebral line rather prominent, sides, straight ; limbs slender ; stands straight ; height from 12-1 to 13-3 hands ; the most common coats are mahogany bay and bright bay ; greyish bay and dappled roan are also found.

The mules are very strong and very quiet, and, when mounted, cover an average distance of 37 miles a day.

2) FIBRE PLANTS. — The Cumana and Barquisito districts, the Andes and the Orinoco Delta supply a large variety of fibre plants belonging to the agaves, Urticaceae, Bromeliaceae and palms. Immediate use of the fibre would give profitable results.

3) OIL YIELDING PLANTS. — There are many varieties of palms in the Orinoco Delta which might be used in the oil industry. Of these the corozos are by far the most important ; the kernels yield a high-quality oil ; 10 tons of nuts give 1 ton of oil, which before the war, was valued at £32.

4) PETROLEUM. — There are petroleum wells in many of the coast districts, and, near them, great reserves of asphalt and bitumen.

5) PLANTS YIELDING TANNIN AND DYES. — These could be put to use immediately and the raw products sent to Europe.

6) FERTILISERS : — The principal fertilisers are : 1) guano, in the south of Barquisimeto, San Juan de la Morros, and of Cumana ; 2) phosphates, in the islands of Avez and Roques, 3) saltpetre, in Bermuda, 4) magnesite, in Margarita Island. Copper sulphate is also found in the pure state in the Villa de Cura district.

B. — *Products requiring preliminary preparation.* — The principal products which require the use of special machinery for their extraction and special transport are iron-ore, copper-ore, lead-ore and silver-ore for export, coal, gypsum, and alumina for home use. Opals, etc., have been found in the alumina districts.

There are great opportunities for the cultivation of gums, especially the rubber of *Hevea brasiliensis*.

FOREIGN INFLUENCE. — There are, in Venezuela, 3 principal districts in which foreign influence predominates : — 1) the eastern district, under French influence, the Sucre peninsula up to Cumana) ; 2) the central district



under English influence, (from Guanta to Zucacas and even Barquisimeto) ; 3) the western district, under German influence.

Although it does not predominate particularly, the North American influence is felt commercially over almost the whole of the country.

Different measures are taken by financial agents, such as the firm of BLUM of Caracas, to assure the harvest and cultivation of the land. The most common of these are loans for which the securities are the standing crops, or even the land itself. On the one hand there is a real and urgent need of funds, on the other, pressure by the agent. The security is fixed according to the average of many years ; once fixed, the value decreases by 3, 4 or 5 *bolivares*, and even more, per unit (sack of coffee, cocoa, etc.) put on the market. The money is lent at 1 %, 1.5 %, and sometimes 2 % per month. Only a year of exceptional harvest can free the borrower.

POLITICAL POSITION OF VENEZUELA CONSIDERED FROM THE POINT OF THE GEOGRAPHICAL POSITION AND FUTURE OF THE COUNTRY. — Venezuela is at the entrance of the Panama Canal, and is the South American State nearest to Europe. The opening of the Panama Canal assures it a new outlet for its natural products. It will be able to supply the boats using this route with both food and fuel. Though not so near to the canal as Colombia, it has superior means of communication connecting its ports with the interior. It is, therefore, in an extremely favourable position.

Everything still remains to be done in this country. From an agricultural point of view alone, it is pre-eminently a country of the future. It should be noted, moreover, that, up to the present, it has made no loan and has but a low debt which is regularly amortized each year, and which is comparatively insignificant in comparison with its ever increasing general commerce.

700 — **Agriculture in Queensland in 1915-1916.** — *Annual Report of the Department of Agriculture and Stock for the Year 1915-1916*, pp. 1-158. Brisbane, 1916.

The total area of land under cultivation during 1915 was 1 059 401 acres, an excess of 78 183 acres over the preceding year, an increase that was to a great extent due to the encouragement given in 1915 by the Government to add to the land under wheat, so as to make, as far as possible, Queensland self supporting. The drought, however upset these aspirations and all the main crops showed a decrease in acreage and in production, excepting bananas, which rose from 7796 acres to 8166 acres ; pine apples from 3423 to 3709 acres ; and apples from 2020 acres to 2179 acres. The produce per acre from the bananas and pineapples, too, was greater upon an average than for the preceding year, bananas producing 148 bunches to the acre, as against 136 bunches and pineapples 248 dozen as against 240 dozens.

All the grain crops, excepting rye and rice, showed much reduced average yields, but the value of farm crops did not, owing to the higher rates ruling in the markets, show such comparative falling off.

The number of holdings that may be classed as farmsteads was 24 828, an increase of 375 or 1.11 per cent. on the preceding year, and an increase of 5 889 over 1906, and an increase of 39.06 per cent in relation to 1904.



The total number of persons engaged in farming and in dairying was 58 840 and of these 1331 males and 1438 females were engaged in dairying. The total use of machinery and implements required for use in agriculture and dairying was £ 1 856 192. The total number of holdings upon which land was cultivated was 22 095, of which there were 2380 cultivating under 5 acres, 6488 owners of between 5 and under 20 acres, 6718 from 20 acres up to 50 acres and 6409 owners of 50 acres and upwards, the total acreage under cultivation being 1 059 401 acres.

*Dairying.* — The figures of the Government Statistician show that the total milk in 1915 was less than the preceding year by 30 per cent, the figures respectively being 70 093 674 gallons and 100 189 876 gallons. The output of butter was reduced by 32 per cent, of cheese by 45.45 per cent., the number of butter factories in operation being increased by one and of cheese factories by seven. In 1914 there were 387 311 cows and in 1915 the number was reduced by over 52 000 on account of the drought, the reduction in the quantity of butter being equal to about 5211 tons.

*Live Stock.* — The reduction in live-stock during 1915 was less than in the drought year of 1902 excepting with regard to sheep, as will be seen from the following comparative figures :

	% of Reduction 1902	% of Reduction 1915
Horses . . . . .	13.63	7.56
Cattle . . . . .	32.58	12.37
Sheep . . . . .	28.08	31.04
Swine . . . . .	36.53	29.03

There were on the 31st. December 1915, 686 871 horses, 4 780 893 head of cattle, 15 950 154 sheep and 117 787 pigs in the State, the reduction in each case being of horses 56 188, of cattle 675 050, of sheep 7 179 765 and of pigs 48 851. It is interesting to note that the number of owners of 100 head and under increased by 728 persons and that the total number of owners of cattle increased by 335 persons, notwithstanding the decrease in the stock as a whole. The average number of cattle held by 40 051 persons was 119 head. Of the total number of sheep there were 4091 owners and the average number of the flock was 3899.

With regard to sheep, however, is is hardly fair to take an average of the whole number, from the point of view of the number engaged in the industry. For instance, there were 2447 persons who owned a thousand head, or less, and 175 persons who held from 20 000 upwards, the latter class owing 7 585 655 sheep, or about one-half of the whole number.

An idea of the progress of sheep farming by the smaller holder is to be found in the holders of under 500 head, of whom there were 2013 against 1492 people in 1914.

The percentage of lambing was 29.60 per cent in 1915 as against 54.10 per cent. in 1914, the number of lambs dropped in 1915 being 2 146 471.

There were, in 1915, 117 787 head of swine in the State, while the export

and home consumption requirements are 216 253 head. This position was not caused by the drought, but is experienced every year.

*Meat Trade.* — There were 23 establishments for meat preserving or for bacon curing in operation during the year, and these employed 5050 persons, the value of the machinery and plant being £ 944 059, land and premises to the value of £ 893 094, and the output was worth £ 6 478 833, a decline of between 8 per cent. and 9 per cent. on 1914.

*Wool.* — The wool market during 1915-1916 totalled in Brisbane 246 376 bales, against 182 376 bales for the year to 30th June, 1915. Excepting 2749 bales of New South Wales wool, the whole was of Queensland growth, and was made up of 97.5 per cent of merino wool and 2.5 % of cross-bred and all strong wool.

Reduced to pounds, the sales consisted of 61 283 049 lb. of greasy wool of an average value of 11.1 d. per lb. and 15 285 896 lb. of clean wool of a value of 22.5d. a lb. or a total value of £ 4 279 498.

*Sugar.* — The sugar season of 1915 resulted in a shortage of approximately 100 000 tons due to the severe drought experienced in nearly all the sugar districts of Queensland. The total acreage under cane in 1915 was estimated to be 153 027 acres, a decrease of 8168 acres compared with the previous year. Of this cane from only 94 459 acres was crushed. This resulted in a yield of cane of 1 152 516 tons, or an average of 12.2 tons per acre, an abnormally low figure. The amount of cane used by the mills to manufacture one ton of sugar was 8.2 tons, a lower figure than at any time heretofore.

The work of the Bureau of Sugar Experiment Stations has been continued in the direction of the introduction of successful varieties of cane from other countries. The analytical and commercial testing of the varieties raised by the Queensland Acclimatisation Society, and presented by the Sugar Bureau has now been completed, and many of these new canes are being distributed free to cane growers.

701 — **The Relation of Farm Weeds to Hay Fever.** — HALL, H. M. in the *Monthly Bulletin of State Commission of Horticulture*, Vol. VI, No. 2, pp. 44-47. Sacramento, California February, 1917.

RURAL  
HYGIENE

It is estimated that each year more than 100 000 people in the United States suffer from hay fever. Anemophilous plants, being the richest in pollen, are the most liable to cause the fever. In determining the agent the "biological test" is used, that is to say, a small quantity of the suspected pollen is placed on the nostrils or the corner of the eye of a person susceptible to hay fever, the symptoms of which develop in positive cases. Epidermic reactions with pollen solutions are also used. Immunity may be obtained by the injection from time to time of a vaccine prepared from the kind of pollen to which the patient is susceptible. This immunising treatment is still in the experimental stage.

The causes of this illness have been thoroughly studied by the American Hay Fever Prevention Association, the plants causing it have been determined, their injurious effects made known to the public and the suppression attempted by means of both cooperation and legislation. These



methods have greatly reduced the number of cases in certain districts, notably in New Orleans.

Plants causing hay fever have also been studied in California. With the co-operation of the Faculty of Botany of the State University, of botanists and doctors, the above-mentioned Association has collected and examined the pollen of many suspected varieties. The results obtained so far show that the greater part of the forage Gramineæ cause spring hay fever; Johnson grass (*Sorghum halepense*), ray grass (*Lolium italicum*), and a mixture of timothy grass and *Agrostis vulgaris* all give a positive reaction to the biological test. The pollen of the Gramineæ is, however, usually less harmful than that of other families, particularly the Compositæ. The following plants, other than Gramineæ, have so far been found to cause hay fever; they are given in decreasing order of perniciousness.

Western Mugwort (*Artemisia heterophylla*), Western Ragweed (*Ambrosia psilostachya*), Cocklebur (*Xanthium pennsylvanicum*), False Ragweed (*Franseria acanthicarpa*, *Franseria tenuifolia*), Curly Dock (*Rumex crispus*), Pigweed (*Chenopodium album*), Wormseed (*C. anthelminticum*) (the last 3 only give a weak reaction), *Atriplex* sp. (*Atriplex bacteosa* gave a well-marked reaction with one patient).

The following plants are strongly suspected:

Sand-bur (*Franseria dumosa*), Poverty Weed or Western Elder (*Iva axillaris*), Budbush (*Artemisia spinescens*), Russian Thistle (*Salsola Kali*), Hymenoclea (*Hymenoclea Salsola*), Guatamate or Mule Fat (*Baccharis viminea*), Spiny Clotbur (*Xanthium spinosum*), Sneezeweed (*Helenium puberulum*), Iodine Brush or Kern Greasewood (*Spirostachys occidentalis*), Hop Sage (*Graya spinosa*).

**702 - Agricultural Experimentation in the Argentine Republic.** — *Ministero de Agricultura de la Nación, Dirección General de Enseñanza y Investigaciones Agrícolas*, N° 42, pp. 1-572. Buenos-Ayres, 1915.

The Director of Agricultural Education and Experiments (Ministry for Agriculture of Argentine) has published this monograph on agricultural experimentation, including, besides an historical part, an account of its present state and organisation under existing rules, together with an account of all the plans for experiments to be carried out at each of the agronomic and experiment stations.

The task given to the Sections of the Agronomic and Experiment Stations (which depend on the Ministry of Agriculture) is: to acclimatise, select and produce varieties suitable for agricultural purposes; to study the cultural conditions most suitable for the different regions; to determine the exact quantity of water necessary for irrigation and according to the various cultural systems; to consider the possibility of industrialisation of certain agricultural products; and to compare, to this end, the different methods and propose the most suitable ones.

For this purpose, the Section has an œnological station at Concordia, 5 agronomic stations of a scientific character in the different zones of the country, that is: Alto de Sierra (Andes zone), Guêmes (subtropical zone), Pergamino (central zone), Guatraché (La Pampa zone), Rio Negro (southern zone of irrigated valleys); new experiment stations for demonstra-



tion purposes, established in places well chosen from the geographical point of view (Loreto, Colonia Benitez, Bella Vista, Catamarca, la Roiija, La Banda, Gündara, Tigre, 25 de Mayo) and 5 experiment substations for cereals, of highly scientific character, divided in the cereal zone (San Jorge, Pontant, Guatraché, Bengolea and 25 de Mayo).

Each agronomical station and experimental station, according to law, receives an annual subsidy of 612 000 pesos and 6000 pesos respectively.

The programme of work includes 234 projects for experiments, for each of which are indicated: the place of the experiment, the aim, the manner of procedure and the approximate cost.

### CROPS AND CULTIVATION.

703— **Influence of Temperature and Moisture on the Growth of Millet**(1). — BIELOV, C. A., in *Труды Бюро по Прикладной Ботанике* (Bulletin of Applied Botany), Year 9, No. 7, (92), pp. 333-351, fig. 9. Petrograd, 1916.

AGRICULTURAL  
METEOROLOGY

In the *Panicoidae* group, the second flower of the spikelet usually has neither andraecium and nor gynaecium; it is only in exceptional cases that it is of normal formation, capable of being fertilised and of forming seed. In the district in which is situated the Besencink agricultural experiment station (South-Eastern Russia), after an unusually wet year, such as that of 1913, the phenomenon of two grains per spikelet is more frequent, thus producing an increased yield. In very dry districts production increases in proportion to the length of the growing period, which is in direct ratio to the total precipitation.

This phenomenon is shown in the following table, which gives the results of a series of pot experiments.

TABLE I. — *Duration of the period of growth of millet at varying degrees of soil moisture (pot experiments, 1914).*

Soil moisture	20 %	40 %	60 %	80 %
<i>Panicum miliaceum</i> L. var. <i>compactum</i> (red).	88 days	95 days	106 days	106 days
» » » » (white).	91 »	95 »	106 »	106 »

In proportion as drought increases and the period of growth diminishes, the number of seeds formed and developed also diminishes progressively, the more so as the average size of the seeds is greater. Therefore, when selecting a variety of millet (*Panicum miliaceum* L.) well adapted to dry, arid climates, preference should be given to small-grained types. A series of parallel meteorological and biological observations was undertaken

(1) See B. March. 1917, No. 221.

to demonstrate and study the nature of the close relationship between flowering and weather. The results showed that: 1) during very damp and misty days the flowering glumes do not open at all; 2) if there is a high temperature, little moisture and a clear sky, flowering begins at 8 a. m., and may even be advanced by an hour by concentrating the sun's rays on to the closed flower by means of a magnifying glass. This procedure loses its efficacy as the day advances and gives completely negative results after 11 o'clock. The maximum flowering energy (separation of the glumes and appearance of the stamens) occurs between 10 and 11 o'clock, and is considerably reduced after midday.

In the Samara district there is such a close and well-marked meteorological and physiological relationship that it is possible, by studying the manner and rate of flowering, to form a fairly exact idea of the course of the thermal and hygroscopic values.

704 - **Factors Affecting the Evaporation of Moisture from the Soil.** — HARRIS, F. S. and ROBINSON, J. S. (Utah Agricultural Experiment Station), in the *Journal of Agricultural Research*, Vol. VII, No. 10, pp. 441-461 + fig. 1-17. Washington, D. C., 1916.

Soil moisture, which is of great importance in agriculture, may, in arid districts, be lost either by capillary attraction, which draws the water to the surface, or by evaporation, which is one of the most important factors in preserving the moisture of the soil. This paper gives, first a critical review of the scientific literature on this subject, then a description of a series of experiments undertaken from 1912 to 1916 in different soils and under varying conditions.

The results show that the evaporation of the water of the soil is in direct connection with the original moisture; the differences are slighter when there is much moisture than when there is little, and there appear to be critical points at which evaporation undergoes sharp variations. Evaporation in moist soil diminishes very rapidly in proportion as the moisture in the air increases. Air currents cause an increase in evaporation, which, however, becomes very slight beyond a certain velocity. In completely saturated soils evaporation is greater when the soil particles are fine than when they are coarse. Decrease in sunshine causes a great decrease in evaporation, which is also affected by sudden variations in temperature, however slight they may be. Evaporation is effectually restricted by a thin, dry mulch but more so when the particles are coarse than when they are fine. Compacting the surface increases evaporation. Finally, evaporation may be reduced by the addition of a concentrated solution of soluble salts.

A bibliography of 41 publications is appended.

705 - **The Effect of Soil Moisture Content on Certain Factors in Wheat Production.** — HARRIS, F. S. and MAUGHAN, H. T., in *Utah Agricultural College Experiment Station Bulletin* No. 152, pp. 1-15 + figs. 1-15. Logan, Utah, February 1917.

A knowledge of the intimate relations between the crop and the moisture of the soil is important to every farmer, particularly to those in arid districts. For this reason the authors carried out experiments to determine the water requirements of wheat and the water content of the soil during various stages in the growth of the crop.



The experiments were carried out during the years 1913, 1914, and 1915 in 36 galvanised iron tanks, each of which contained 476 pounds of water-free loam with a high lime content. Spring wheat was sown and evaporation prevented first by a  $\frac{1}{2}$ -inch sand mulch, and later with paraffined paper; any loss was made up with very pure tap water. The tanks were divided into 18 series of 2 tanks each, the series having varying moisture conditions. The life of the plant was divided into 3 periods: 1) from planting until there were 5 leaves; 2) from the 5-leaf stage to full earing; 3) from full earing to maturity.

The results showed that the highest yield of grain was obtained when the the soil contained about 20 % moisture throughout the season. This was about  $\frac{1}{3}$  of the moisture required to saturate the soil completely. Wheat seems particularly sensitive to soil moisture during the period immediately preceding earing.

There was a greater loss of moisture by evaporation and transpiration from soil producing a large crop than from a free water surface, but the loss was greater from the water surface than from a soil producing only a small crop.

Under favourable moisture conditions the crop was 20 times as great as under unfavourable ones. Wheat may suffer as much from excessive moisture as from excessive dryness; the importance of favourable soil moisture conditions is, therefore, clear.

706 - **Rainfall, Irrigation and Subsoil Water in the United Provinces of Agra and Oudh.**

— MOLONY, F. A., in *The Agricultural Journal of India*, Vol. XII, Part I. pp. 84-89. Calcutta, January 1917.

The writer has examined the rainfall and irrigation statistics in the United Provinces and shows that in the last 29 years the increase in well irrigation is 52 per cent. the increase in canal irrigation 72 per cent., while the decrease in tank irrigation amounts to 29 per cent. The writer is of the opinion that these differences are too great to be explained entirely by rainfall.

In the United Provinces nearly 58 per cent of the total irrigation is done from wells. This fact, coupled with the very general complaint heard of late years that the water level in the subsoil shows a serious fall, indicates the desirability of examining the underground water supply in order to ascertain if it can stand permanently the existing strain on it, particularly because of the much greater drain caused by construction of many new wells and improved methods of lifting the water.

Examination of statistics for the last 20 years shows that there has been imposed on the subsoil water supply an additional drain amounting to the water used for the annual irrigation of 2 million acres. From this and judging from the areas irrigated by canals and tanks in addition to wells, it seems clear, leaving out of account variations in the rainfall, that the annual net addition to the subsoil water supply is less than it was 20 years ago. If well irrigation continues to extend, it seems clear that the fall in the subsoil water must continue. In years of good rainfall the fall will be arrested, giving a temporary relief only.



As possible remedies or at least palliatives, for the stopping the fall in the subsoil water level, the writer suggests that :

- 1) the great fall in the area irrigated from tanks is due to the policy of surface-drainage, which has probably been carried too far ;
- 2) at times when the irrigation water was not all used, the surplus water should go to fill the tanks and not run to waste. Irrigation done from tanks thus filled might be charged at a lower rate as an inducement to save the waste ;
- 3) attempts might be made to increase the supply of water to the subsoil by excavating wells in the beds of tanks or streams so as to make a direct communication between the surface and subsoil water. It is possible that drainage into the subsoil would be found to possess nearly all the advantages of surface drainage without its great drawbacks ;
- 4) keeping all the land under the plough is the most efficacious remedy, but the cost would be immense ;
- 5) in undulating country much water might be saved by extending the practice of constructing field or ravine embankments.

707- **The Drainage of Irrigated Shale Land.** — MILLER, D. G., and JESSUP, I. T., in *United States Department of Agriculture, Bulletin No. 502*, pp. 40, fig. 12 & IX plates. Washington, D. C., April 23, 1917.

Drainage is one of the most important problems to be solved by farmers of irrigated lands, especially those consisting largely of shale which may or may not outcrop, and in which the soil is made up largely of dis-integrated shale. Such soils are found in all the Rocky Mountain States, and it is with them that this bulletin is concerned. The geological features, surface topography, and underground water systems in their relation to the different types of shale of the district, are first described. This is followed by a study of the most suitable drainage methods to be employed.

The main conclusions may be summarised as follows :

Shale is an important factor in the movement of underground water, especially in those areas where uplifts and displacements have occurred.

Shale may influence the movement of seepage water in 3 different ways ; it may pass : 1) over the top of the undisturbed and impervious strata ; 2) between the layers ; 3) through joints, faults and cleavage planes.

The minor features of the surface of the underlying shale are frequently quite irregular and are masked by the overlying soil. They can only be determined by soil borings.

The source of the seepage water is deep percolation, resulting from irrigation and from seepage losses from cauals and laterals.

Artesian conditions exist usually where the seepage water moves through the shale, although the pressure may be low owing to a large number of areas of leakage in the confining medium.

There is a relation between the seepage areas and the topography of the underlying shale. The affected areas usually occur near shale ridges and points. This is because there is a greater porosity in the shale ridges than in the deeper zones, as the ridges, having sustained the effects of weathering, are more shattered and fractured, while the points are more

open and greater in number. Moreover, the soil covering is shallowest over the ridges.

The deeper zones carry most of the water owing to continuity and greater area of cross section, and the general movement of the water is parallel with the main jointing systems of the shale.

Practically all shales are rich in alkali and the seepage waters leach out large quantities. Consequently many of the waters discharged from drainage systems in shale have a salt content as high as 2 and 3 %, in which are many nitrates. Because of this condition of the seepage water the water-logged soils of shale lands rapidly develop a severe alkali problem.

Shale lands cannot be drained by the ordinary methods because of the movement of the water through the shale under pressure and also because of the extreme retentiveness of the overlying adobe soil.

The 3 essential factors for the successful drainage of shale lands are : 1) proper location of drains ; 2) sufficient depth ; 3) relief wells.

Drains must be located so as to tap the contributing shale features, such as ridges, points, knolls, etc. This necessitates careful and complete preliminary examination.

The amount of shale reached and the amount of water developed are augmented by increasing the depth of the drains. These depths should never be less than 6 feet, and generally depths of 7 and 6 feet and more are essential to success.

A system of drainage in many of the shales will be incomplete and unsuccessful without relief wells.

These relief wells are simply artesian wells. This does not necessarily mean that the water rises to the surface and overflows, since any well may be considered as artesian where the water rises to some extent after having been drilled through a comparatively impervious stratum into one carrying water ; in other words, where the water enters the well under pressure.

Seepage areas occur almost invariably where pressure conditions exist and the movement of the water is upward. In a few cases only is it possible to place the drains deep enough to reach the supply of water that causes the saturation. Often the water-carrying zones of shale have been found at depths of 30 feet. The cost of installing drainage lines becomes prohibitive long before this depth is attained, but unless the water-carrying medium is reached drains will be of little service however carefully they may be located and constructed, or however closely they may be spaced. There are cases in which drainage systems have been constructed in shale to a depth of 7 feet and developed considerable quantities of water, and yet seepage water rises to the surface.

Flowing springs have been found within 10 feet of a 7 foot trench. These results show clearly that ordinary methods of drainage will not relieve seepage conditions where the water is supplied under pressure.

The purpose of the relief well is to connect the tile line with the deeper strata which are the sources of the seepage water and to relieve the pressure by allowing the water to pass out freely. As the area of influence of relief wells is small they should be closely spaced, in many cases 5 or 6 to



100 feet of trench. The depth of the wells should be from 6 to 20 feet below the bottom of the tile drain. The greater part of the water developed by most of the drainage systems in shale comes from the relief wells. A diameter of 2 inches is sufficient for the relief wells, and in most of the shales they have been installed with a soil auger. Frequently, however, hard strata require the use of a churn drill.

The cost of labour for trenches in shale ranging from 6 to 7 feet in depth is \$ 0.25 per hour. The unit costs of excavating, laying tile and back-filling, together with the cost of installing the relief wells, range from \$ 0.12 to \$ 0.25 per linear foot of trench. This does not include the cost of material for the drains.

The cost of drainage of the lands referred to in this bulletin ranged from \$ 13 to \$ 100 per acre.

Once seepage trouble has developed in shale lands it increases rapidly. The quantity of the alkali salts at or near the surface also increases rapidly in water-logged lands of this type. The drainage problem and that of removing excessive salts are simplest, the construction most economical, and the results most satisfactory therefore if the drains are installed at the first sign of the trouble.

708 - **Spray Irrigation.** — WILLIAMS, MILO B., in the *United States Department of Agriculture Bulletin* No. 495, pp. 40, figs. 19. Washington, D. C., February 14, 1917.

During the last 10 years spray-irrigation (1) has spread greatly through the United States, particularly in the Atlantic Coast from Massachusetts to Florida. It is particularly well adapted to supplement uncertain rainfall in market gardens and orchards. The economic conditions must, however, be favourable, as the cost of installing this system is relatively high. While a portable outfit may cost only \$ 50 per acre, a stationary distribution system may cost as much as \$ 150 per acre, not including the cost of a pumping plant and the laying down of a main pipe line to the fields.

The cost of installing a stationary plant for a small acreage amounts to \$ 250 per acre, and the annual incidental expenses come to \$ 51 per acre. The high cost prohibits the use of this method for many crops, but if it is combined with ordinary irrigation methods the expenses are less heavy. Spray irrigation is practically independent of the topography of the field, and can be applied to land too rolling or rough for surface methods.

As spray irrigation is comparatively recent, the author carried out various tests to determine the amount of water required by this system.

In damp climates amounts not exceeding  $\frac{1}{4}$  inch are considered sufficient for seed beds and young vegetables, whereas maturing garden crops and strawberries require  $\frac{1}{2}$  to 1 inch. In the growing season markets gardens need from 4 to 6 inches. The Florida citrus groves may require as much as 3 inches per irrigation.

In arid districts market gardeners irrigate every 3 or 4 days, while citrus growers apply from 4 to inches each time. As a rule, in damp districts

(1) See B. 1912, Nos. 486 and 627; B. 1914, No. 1090; B. 1915, Nos. 95 and 1330. (Ed.)



a depth of 1 inch per week suffices, but in arid districts 1 ½ inches per week is required. Information is given on the installation of pumps, and the sinking of sumps, shallow wells and deep wells.

Three types of spray irrigation have been generally adopted :

- 1) Hose and movable nozzle or movable lines fed from an underground pipe system and hydrant ;
- 2) Circular nozzles fed from an underground pipe system ;
- 3) Overhead spray lines fed from an underground main feed pipe.

The hose and movable nozzle type has long been in use, chiefly for watering parks and flower beds, and also in some Florida citrus groves. A modification of this system is the use of a ¾ inch pipe, 18 to 20 feet long, containing a row of small nozzles similar to those used in overhead irrigation systems. This pipe, connected to the water supply by a hose, is supported by movable or stationary tripods.

Stationary nozzles fed by underground pressure systems of piping are much in favour in Florida for market gardens or citrus groves where the sandy character of the soil demands rapid irrigation. The water is driven up by pressure through an underground steel or wrought-iron pipe, but the main feed pipe is sometimes in cast iron or riveted steel. Laterals are placed 12 to 15 inches below the surface in parallel lines. At intervals of 30 to 50 feet risers are placed on the laterals, at a height of 4 to 6 feet above the surface for market gardens, and at a height above the trees in orchards.

The risers are placed alternately in lines as is shown in figure 1. Each lateral is controlled by a valve, and, in some cases, the risers too are fitted with valves, so that the water may be cut off as necessary.

### *Spray irrigation system.*

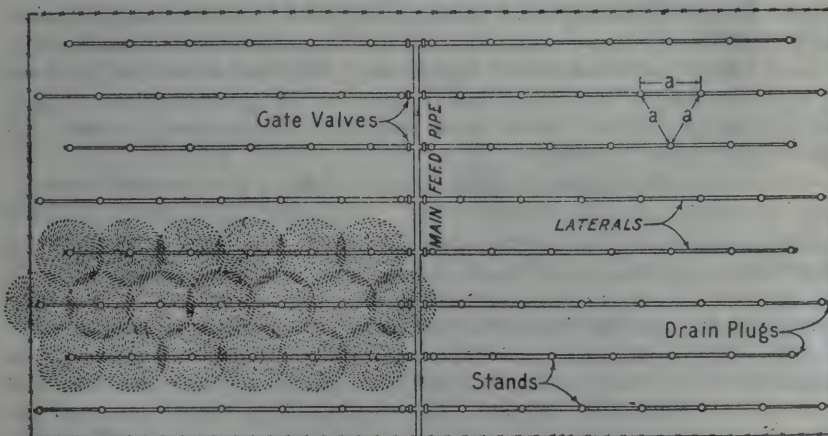


Fig. 1. — Plan for piping a field for stationary-nozzle spray systems, showing the positions of nozzles.

Figure 2 shows the fittings for the stationary-nozzle spray system.

The nozzles vary in design, but may be divided into 3 groups: 1) solid nozzles with no movable parts; 2) adjustable nozzles with parts which can be manipulated to change their capacity or form of spray; 3) rotatory nozzles. A series of experiments carried out in 1909 on the efficiency of various nozzles, showed that, in every case, the distribution of the water is very uneven. The solid and adjustable types placed the maximum amount within a radius of about  $\frac{3}{4}$  that of the sprayed area.

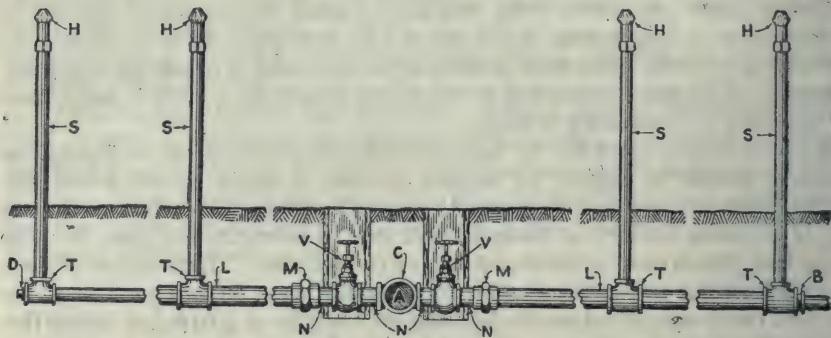


Fig. 2. — Sketch showing typical fittings of underground laterals for stationary nozzle spray systems:

A, Main feed pipe; B, bushing at reduction of pipe sizes; C, cross in main feed pipe; D, drain cock or plug; H, nozzles; L, lateral pipe lines; M, malleable unions; N, nipples; S,  $\frac{3}{4}$  inch galvanised stand pipes; T, malleable tees; V, brass gate valves.

The rotatory nozzles distribute the greatest amount of water near the centre, and the amount received decreases with the distance from the nozzle. The cost of this system exceeds that of the hose and portable nozzle, and, in many cases, that of overhead equipment. The cost of working is about the same as that of the overhead system, but it is usually less efficient than this latter method; one of the drawbacks to this system is that it distributes the water unevenly.

The stationary overhead spray system marks a great forward step in spray irrigation, for commercial crops. Originally this system consisted of a few lengths of steel pipe set on parallel rows of posts and connected with a hand force pump. A series of small holes were drilled in the pipe through which water could be forced in the form of spray. In order to remedy the clogging of the holes, they were replaced by small brass nozzles, screwed into the pipe. So that a piece of land 50 ft. wide could be irrigated all over, the nozzles were placed on pipe lines that could be turned or rolled in bearings. Figure 3 shows the underground system of the main pipe and the arrangement of the overhead pipe lines. The main pipe should be made to run as straight as possible; the nozzle lines should run perpendicular to the main pipe.

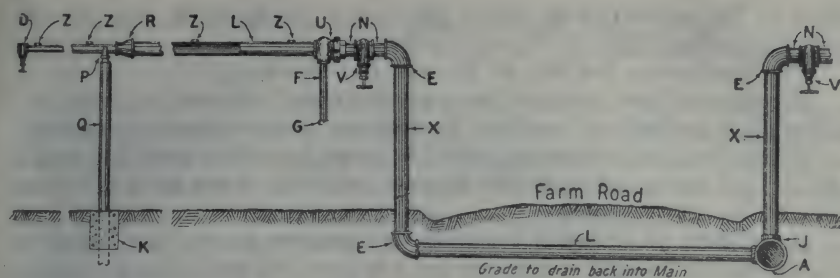


Fig. 3. — Typical fittings for overhead nozzle lines connected to main feed pipe and method of crossing a farm road.

A, Main feed pipe; D, drain cock or cap; E, elbow; F, handle for turning nozzle lines; G, cap on handle; J, side-outlet tee; K, concrete base for pipe post; L, nozzle line pipe; N, "long" nipples; P, pipe-hanger; Q,  $1\frac{1}{4}$  inch pipe post; R, reducing cocket; U, turning union; V, brass gate valve; X, risers to nozzle lines; Z, nozzles.

The size of the overhead pipes is dependent on their length, and should not exceed  $1\frac{1}{2}$  inches. The end connecting with the feed pipe must be sufficiently large to carry the full head of water. As the water is diminished by each nozzle, the pipe can be reduced in size, finishing with a  $\frac{3}{4}$  inch pipe at the extreme end. The lines are 50 to 56 feet apart; this allows the water to be sprayed over the whole field. The pipes are placed either on posts or on cables suspended from high posts. This last method allows the passage of horses and unobstructed working all over the field. If wooden posts are used they should not be lighter than 4 by 5 inches, and should be set in the ground at a distance of 2 to  $2\frac{1}{2}$  feet apart. The posts may be either high or low, according to the nature of the crop. Posts for cables should be 100 to 200 ft. apart, and the nozzle line is suspended from a tight cable or wire strand. Telephone posts, 8 to 10 inches at the base and 6 to 8 inches at the top, are very suitable. Both the end posts and the cables must be firmly anchored in the soil. The chief difficulty lies in the cleaning of the nozzles; for this reason the pipe should be kept within reach.

The overhead pipes are usually of galvanised wrought iron or steel; the main underground pipe of steel or wrought iron with threaded joints. Cast iron pipes last longest, and are comparatively cheap. The various types of pump are described, and details for the installation of spray irrigation systems are given.

**709 — Rotations and Tillage Methods in Western Nebraska.** — SNYDER, W. P. and OSBORN, W. M., in *The University of Nebraska Agricultural Experiment Station Bulletin* No. 155, pp. 1-48. Lincoln, Neb. June 1, 1916.

The data reported in this bulletin are the results of experiments in rotations and tillage methods conducted on a series of one-tenth acre plats on the table-land of the North Platte Experimental Sub-Station during the past eight years. This bulletin is a means of reporting progress, or results thus far secured, rather than a report of conclusions drawn from a finished line of investigation. These results are presented in 13 Tables and VI Charts including records of precipitation by months, the weather con-



ditions of the season during which the crop is grown being the greatest factor controlling yields in Western Nebraska.

The conclusions reached so far are the following :

The seasonal precipitation has a much greater influence on crop production than methods of seed-bed preparation, crop sequence or manure.

During favourable seasons profitable crops have been produced by all methods, and during unfavourable seasons profitable crops have not been produced by any methods.

The system of alternate cropping and summer tillage has failed to overcome severe drought conditions and has been less profitable in the production of corn and spring grain than ordinary methods of production (winter wheat is not considered in this report). However, the system of alternate cropping and summer tillage, during some unfavourable years, has given a large increase in yields over common practices and thus has served as a practical insurance against entire crop failure.

From the standpoint of either yields or profits it matters but little whether the land is fall plowed or spring plowed for spring grain or corn.

The spring grain planted on corn-stalk land has not yielded more than when planted on spring-grain stubble, it has given more profit when grown on the corn land on account of there being less labour required in preparation for seeding on corn land. Farmyard manure has not increased the yields sufficiently to pay for the application of the manure, probably because water rather than plant food is the factor controlling production under these conditions. However, it is believed that the use of manure is advisable as a security against a deficiency in fertility and humus.

Green-manure crops are too expensive for practical use under present conditions.

If a value of \$ 4 per ton is given to sorghum hay this crop becomes one of the most profitable crops here considered. During favourable seasons and also under drought conditions it has given a larger tonnage than any other crop.

As a single crop, corn ranks above any of the spring small-grain crops in profit returned where the stover and grain are both used. Corn following corn has yielded 5 bushels more per acre than corn following small grain. Spring wheat ranks next to corn in profit returned in these rotations. It gives the greatest profit where it follows corn.

Oats have proved the least profitable of the crops grown, and have usually been grown at a loss.

Neither alfalfa nor brome grass has been grown successfully in these rotations. The failure of these crops should be expected when grown on high table-land of this character, unless seeded in rows and cultivated. Among the many rotations there was none in which the crops were grown according to common farm tillage practice conducted in a thorough manner that did not give an average annual net profit of more than \$ 1 per acre. The results of this work to date commend the common tillage practices of the farmers throughout this region in so far as these practices are conducted in a thorough and intelligent manner.

710 - The Plant Food Materials in the Leaves of Forest Trees. — SEREX, P. Jr., in *The Journal of the American Chemical Society*, Vol. 39, No. 6, pp. 1286-1296. Boston, Pa., June 1917.

MANURES  
AND MANURING

The investigations described were undertaken to determine the plant food constituents of the leaves of three typical New England forest trees (*Castanea dentata*, *Acer saccharum* and *Quercus alba*) at the beginning and end of their growth (spring and autumn), on branches at different heights from the ground, and in different soils, namely Suffield clay, Holyoke stony loam and Triassic stony loam. The manurial value of the different leaves was also determined.

TABLE I. — *Results obtained for the chestnut.*

Season	Soil	Height of branches (feet)	Dry matter					Estimated value per ton on a 20 % moisture basis (dollars)
			Nitrogen per cent	P <sub>2</sub> O <sub>5</sub> per cent	K <sub>2</sub> O per cent	Manu-rial units	Estima-ted value per ton (dollars)	
Autumn 1913	Suffield clay. . . . .	10	1.954	0.6992	1.489	7.07	5.65	4.52
	" . . . . .	50	1.930	0.6852	1.221	6.72	5.37	4.29
	Holyoke stony loam. . . . .	10	2.438	1.162	0.9917	8.25	6.60	5.28
	" . . . . .	50	2.106	0.9428	1.017	7.21	5.76	4.60
	Triassic stony loam . . . . .	5	2.798	1.333	1.460	9.66	7.72	6.17
Spring 1914	" . . . . .	50	2.991	1.405	1.343	10.20	8.16	6.52
	Holyoke stony loam . . . . .	10	2.959	1.024	1.450	9.87	7.89	6.31
	" . . . . .	50	2.660	0.953	1.747	9.34	7.47	5.97

The highest cash value for the chestnut is obtained from leaves taken from the top branches in autumn in Triassic stony loam.

TABLE II. — *Results obtained for the sugar maple.*

Season	Soil	Height of branches (feet)	Dry matter					Estimated value per ton on a 20 % moisture basis (dollars)
			Nitrogen per cent	P <sub>2</sub> O <sub>5</sub> per cent	K <sub>2</sub> O per cent	Manu-rial units	Estima-ted value per ton (dollars)	
Autumn 1913	Suffield clay. . . . .	15	1.379	0.4948	0.8555	4.79	3.83	3.06
	" . . . . .	45	1.446	0.6305	0.8837	5.11	4.09	3.27
	Holyoke stony loam . . . . .	8	2.126	1.031	1.014	7.34	5.87	4.69
	" . . . . .	50	2.110	1.123	1.193	7.59	6.07	4.85
	Triassic stony loam . . . . .	8	1.907	—	0.7249	—	—	—
Spring 1914	" . . . . .	50	1.420	1.056	1.007	5.61	4.48	3.58
	Holyoke stony loam . . . . .	8	3.201	0.9303	1.614	10.54	8.43	6.74
	" . . . . .	50	3.483	1.079	1.834	11.61	9.28	7.40

In the sugar maple the highest value is obtained from the leaves of the highest branches in spring in Holyoke stony loam.



TABLE III. — *Results obtained for the oak.*

Season	Soil	Height of branches (feet)	Dry matter					Estimated value per ton on a 20 % moisture basis (dollars)
			Nitrogen per cent	P <sub>2</sub> O per cent	K <sub>2</sub> O per cent	Manu- rial units	Estima- ted value per ton (dollars)	
Autumn 1913	Suffield clay. . . . .	12	2.079	0.5182	1.022	6.71	5.35	4.29
	" . . . . .	40	2.097	0.6479	1.325	7.19	5.74	4.59
	Holyoke stony loam .	5	2.475	0.9634	1.007	8.13	6.50	5.20
	" . . . . .	50	2.453	1.091	0.9687	8.18	6.54	5.23
	Triassic stony loam .	10	2.044	0.7295	1.182	7.01	5.60	4.48
Spring 1914	" . . . . .	40	2.255	0.9389	1.280	7.84	6.27	5.01
	Holyoke stony loam .	5	3.175	1.048	1.581	10.55	8.44	6.75
	" . . . . .	50	3.460	0.9399	1.519	11.11	8.88	7.10

In the oak the highest value is obtained from the leaves of the top branches in spring in Holyoke stony loam.

CONCLUSIONS. — Leaves collected in spring have a higher nitrogen and potash content than those collected in autumn. The phosphoric acid content varies with the species of the tree and with the section of the tree from which the leaves were obtained. The lowest nitrogen and phosphoric acid content is found in leaves from trees grown upon a clay soil. The highest content of nitrogen, phosphoric acid and potash occurs in leaves from trees grown upon Holyoke stony loam and Triassic stony loam. In the majority of cases the leaves from the upper branches of the maple and oak have a higher content of nitrogen, phosphoric acid and potash than those taken from the lower branches, whereas, with a few exceptions, the reverse is true for the chestnut. The estimated theoretical cash value of a ton of leaves calculated upon a 20 % moisture basis varies from \$ 3.00 to \$ 6.50, according to the kind of leaves and the portion of the tree upon which they are grown. The cost of collecting and handling would probably exceed the value of the leaves ; it is, therefore, inadvisable for farmers to spend time in this way. Spring leaves usually have a higher value ; at any rate, it is wisest to let the leaves remain where they fall as they contribute greatly to the growth of trees in woodlands. If the acidity of newly-fallen leaves is taken into consideration it is seen that it requires 25 tons of ground limestone to neutralize 250 tons of freshly-fallen leaves of the white oak tree. If the leaves are used in hot-beds, greenhouses, or on the field, it is, therefore, advisable to compost them and allow them to decompose till they have reached the alkaline stage. The slight loss involved by this process through volatilization and leaching is compensated for by the favourable alkaline condition of the leaves and the large amount of alkali added to the soil.



711 - **The Chemical Composition of Basic Slag.** — JANSSENS, VAN RAAIJ, C. (Rijkslandbouwproefstation te Maastricht), *Verslagen van Landbouwkundigen Onderzoekingen der Rijkslandbouwproefstations*, No. XX, pp. 26-33.

Since the beginning of the war two types of basic slag have been put on the Dutch market, one with a low content (7-8 %), the other with a high content (15-19 %) of phosphoric acid. Comparative analyses of these and normal slags gave the following averages:

	Normal Slag — %	Low Standard Slag %	High Standard Slag %
Silica . . . . .	6-7	13.5-17	5.8-14.1
Phosphoric acid. . . . .	16-22	6.8-7.7	14.8-19.1
Alumina . . . . .	0.9	2.1-2.8	1.02-4.0
Total iron as sesquioxide . . . . .	11.8-17	28-32	11.3-17.6
Oxide of iron . . . . .	6-10	—	0.7-8.5
Oxides of manganese. . . . .	7-8	4.3-5	6.3-13.2
Free lime . . . . .	1.5-5.5	6.2-7.8	1.7-5.2
Total lime as oxide. . . . .	47-48	36.6-42.9	46-52.4
Magnesia. . . . .	1.5-2	2.8-3.9	0.7-2.8

As is seen, the two types of slag show, in some cases, a high silica content, probably due to the addition, during manufacture, of fine sand for the purpose of increasing the solubility in citric acid. The content in alumina, magnesia and free lime is rather greater in high standard slag, which also contains much iron, both metallic and combined, whereas its percentage of lime and manganese is low.

The proportion of other components is usually normal in samples of high standard slags.

It is thus seen that the high standard slags now on the Dutch market are equal to the normal ones, and may be freely used in agriculture.

This is not the case with low standard slags, since their high iron content causes the formation of practically useless iron phosphates in the soil, thus ultimately decreasing the phosphoric acid content. Considering the high cost of transport the use of such slags is inadvisable in spite of the shortage of phosphatic fertilisers.

712 - **Estimation of the Cyanamide Nitrogen in Two Calcium Cyanamide and Lime Nitrogen.** — BERKAUT, A. D., HENDRICKSZ, R. D. and WIND, G. (Rijkslandbouwproefstation te Maastricht), in *Verslagen van Landbouwkundige Onderzoekingen der Rijkslandbouwproefstation*, No. 20, pp. 43-51. The Hague, 1917.

From their experiments the authors conclude that the best methods for estimating cyanamide in calcium cyanamide are the two following:

In both cases 2 gr. of finely ground calcium cyanamide are taken and mixed several times with distilled water in a small mortar; it is then decanted and about 950 cc. poured into a graduated litre flask. The mixture is shaken for 1 hour, made up to volume, shaken vigorously and filtered.

If the 1st. method is used 50 or 100 cc. of the filtered liquid (corresponding to 0.1 or 0.2 gr. of calcium cyanamide) are then taken, poured into

a 100 or 200 cc. graduated flask according to the amount of liquid used, neutralised with a 10 % solution of nitric acid and 2.5 or 5 cc. of 2.5 % ammonia added. A decinormal solution of silver nitrate is then added from a burette, the flask being shaken meanwhile. Account is taken of  $\frac{1}{20}$  cc. until the nitrogen combined as cyanamide is precipitated as silver cyanamide and only a slight excess of nitrate left in solution. The mixture in the flask is made up to volume with distilled water, and, after being well shaken, it is filtered, if necessary, through a double folded filter. The solution should be distinctly alkaline. Either 50 or 100 cc. of the filtered liquid are taken, acidified with 5 or 10 cc. of 10 % nitric acid by VOLHARD'S method, i. e. with a decinormal solution of ammonium sulphocyanate and 2.5 or 5 cc. of a saturated solution of ammoniacal iron alum as indicator. Should chlorides or other halogenides be present, these are determined in acid solution by VOLHARD'S method and taken into consideration.

By the 2nd. method, 100 cc. of the original solution containing 0.2 gr. of calcium cyanamide are placed in a beaker. This is neutralised with 10 % nitric acid, and, after the addition of 10 % ammonia, the nitrogen combined as cyanamide is precipitated as silver cyanamide by adding a slight excess of decinormal silver nitrate. During precipitation the flask should be continually shaken. The precipitate is collected quantitatively on the filter and carefully washed. The filtrate, while still moist, is placed in a Kjeldahl flask, which is shaken meanwhile, with 10 cc. of 50 % sulphuric acid, 0.6 gr. of mercury and 20 cc. of a mixture of 1 litre of sulphuric acid (density = 1.84) and 200 gr. of phosphorus pentoxide, which neutralises it. The experiment is then finished by Kjeldahl's method. The filtrate must, of course, be free from nitrogenous substances.

713 - **Inoculation Tests on Lucerne and Lupin Seedlings, in Denmark.** — CHRISTENSEN, HARALD R., in *Tidskrift for Planveol.*, Vol. 21, pp. 97-131. Copenhagen, 1914; and (as original abstract) in *Centralblatt für Bakteriologie, Parasitenkunde und Infektionskrankheiten*, Vol. 46. Jena, 1916.

This paper contains the results of various experiments carried out from 1905 to 1910 at the various Danish agricultural experiment stations, to determine the effect of inoculated soil or pure cultures of bacteria on *Medicago sativa*, *M. lupulina* and *Lupinus luteus*.

Manuring experiments were made at the same time, principally to ascertain whether the value of the inoculation varies in unmanured soils and soils treated with calcium salts.

The tests show that, where *Medicago sativa* and *M. lupulina* are concerned, the inoculation with bacterial cultures gives the same results as that with inoculated soil, providing that good material of known origin is used. The American bacterial cultures, supplied by the Washington Department of Agriculture, proved entirely unsatisfactory, whereas the soil cultures prepared by the author himself, and those obtained from the "Biologisch-chemisches Laboratorium" and the "Agrikulturbotanische Anstalt" of Munich, proved of value.

Experiments, carried out in many districts, in no wise confirmed the great virulence attributed to the pure bacterial cultures of the Munich "Agri-



kulturbotanische Anstalt", which only have about the same effect as inoculated soil. On lupins, at the Tylstrup Station, inoculated soil gave better results than the bacterial cultures.

On the other hand, inoculations with bacteria are carried out more rapidly, and may even prove less expensive, especially when the prepared soil comes from a great distance. With pure cultures the danger of introducing fungus spores or weed seeds into the soil to be inoculated is avoided. When choosing soil for inoculation, care should always be taken to ascertain that it comes from districts free from weeds and where young Leguminosae show a strong and healthy growth.

Crushed root nodules suspended in water ("Knuste Rodknolde"), are only suitable for local experiments as they spoil during carriage and do not keep for long. Their action has not yet been closely investigated.

The specific action of the inoculations is more marked in unmanured plots than in those treated with mineral fertilisers. Presumably in the latter case, the chemical compounds, particularly the calcium carbonate, introduced into the soil before inoculation, facilitate the growth and increase of the bacteria already in the soil. However that may be, during the 1st. and 2nd. year, the cultures exert a strong and well-marked action, even in manured soil, and favour the strong and luxuriant growth of the young plants.

The application of nitrate of soda in quantities of 178 lbs. per acre during the first year (year in which the plants are sown), gave quite insignificant results, and cannot replace inoculation. On the other hand, nitrogenous mineral fertilisers cause the weeds to grow at the expense of the leguminosae, clover or lupin, and should, therefore, not be used.

714 - **Report on Humogen.** — RUSSELL, E. J. in *The Journal of the Board of Agriculture*, Vol. XXIV, No. 1, pp. 11-20. London, April, 1917.

This paper gives an account of experiments carried out in 1915 at the request of the Board of Agriculture in order to determine the fertilising value of "humogen". This product is prepared by Prof. W. B. BOTTOMLEY's method as follows: peat is first neutralised, bacterial decomposition is then brought about to a certain point, and the peat finally inoculated with a culture of nitrogen-fixing organisms.

The author reviews the results obtained by other workers — those of the discoverer, at Kew (1) of CHITTENDEN, at Wisley (2), of VOELCKER, at Woburn (3), and at the Midland Agricultural College. These experiments were largely unfavourable, whereas others, carried out at Sparsholt, were favourable up to a certain point, without, however, offering sufficient guarantees. Further tests made at the Lea Valley Experiment Station were also unfavourable (4).

In the experiments described, carried out partly at Rothamsted and

(1) See *B.* 1914, Nos. 410 and 1102.

(Ed.)

(2) » *B.* 1916, No. 497.

(3) » *B.* 1916, No. 846.

(4) » *B.* 1914, No. 982.



partly at the Harper Adams Agricultural College, two qualities of humogen were used, one prepared by the Manchester Corporation cleansing Department, from peat from Chat Moss, the other prepared by the Entwistle Mountain Peat Estate Company from peat overlying limestone deposits. Usually 10 cwt. per acre were used. The experiments were made with mangolds, pot plants and mustard in pots, and water cultures of barley.

All the experiments gave negative results and do not permit the assumption that humogen possesses any particular agricultural value. This is all the more notable as it was said to be 50 times as efficacious as manure, whereas it does not surpass any other organic manure with the same content of nitrogen. The price asked, £5 per ton, is in no wise justified by the results obtained. As these results contradict the statement made by the authors, two circumstances must be borne in mind: *a*) good results were without doubt obtained in the pot experiments at Kew and Wisley; *b*) the composition of humogen is obviously very variable.

Humogen, in the proportions used at Kew and Wisley (1 part to 7 or 8 parts of soil), may be a valuable addition to the compost used for potting up plants, but it does not appear to be superior to an equal amount of untreated peat in an equally fine state of division. This finely-divided organic matter is useful for several purposes in pots and when it forms 12 % or more of the whole bulk it may have a favourable effect. It is quite possible that heavy dressings would have good effects on poor soils, but they would have to be on a far larger scale than is possible at present prices.

The composition of humogen is far from uniform. Prof. BOTTOMLEY's analyses show it to contain 4.310 % of total nitrogen. Analyses made at Rothamsted of humogen from Manchester showed a nitrogen content of 0.570 % in the fertiliser as sent out, and of 1.29 % in the dry matter; analyses of Entwistle humogen showed the corresponding values to be respectively 0.431 % and 1.32 %. In some samples Dr. VOELCKER found 0.48 % of soluble nitrogen, in others only 0.08 %.

This variability is very unfortunate. It is possible that some samples have acted well in the field; it is certain that others have not. There is no definite evidence that "bacterisation" really adds to the value of the peat. The wisest plan would seem to be to concentrate on experimental work and to stop all propagandist operations until some definite basis of incontrovertible fact has been attained. It will take a long time to obtain this result as the problem of utilising peat is sufficiently difficult to occupy the whole attention of a laboratory for some years.

A proof of this paper was sent to Prof. BOTTOMLEY, who, in a note, states that the product sent to the author as humogen was wrongly prepared and was in no way composed of bacterised peat.

of plants (1), it was necessary to have an artificial medium free from this body and, as far as possible, from any other mineral or organic substance.

The author was able to make this medium by the use of bakers' ash. The ash is ground, heated till red, boiled with hydrochloric acid, and, finally, thoroughly washed with distilled water (2). This medium, very poor in all salts and in fluorine, is excellent for cultures, and may be recommended to botanists as an excellent substitute for glass, cotton, silicious sand washed either with acids or pure water. The ash affects neither soil nor water cultures.

716 - Some Studies on the Germination of the Seed of *Oryza sativa* and *Zea*

**Mays.** — NAGAI ISABURO in *Journal of the Tokio College of Agriculture*, Vol. III, No 3, pp. 109-158 + IX plates. Tokyo, July, 1916.

This paper gives the results of experimental and bibliographical researches into the physiology of the germination of the seed of Gramineæ in general and of *Oryza sativa* L. and *Zea Mays* L. in particular. The work is divided into 5 sections:

- 1) Rôle of the selective permeable septum of the seed covering in the viability of the seed.
- 2) The seat of the selective-permeable septum in the seed covering.
- 3) Effect of H and OH ions on germination.
- 4) Rôle of oxygen on germination.
- 5) Influence of extremes of temperature on the germinative power.

The most important results were as follows:

1) Dessicated rice and maize grains are far more resistant than air-dried ones. Twenty-four hours steeping in chloroform, acetone, commercial absolute ethyl alcohol, picric acid (saturated solution), absolute ethyl alcohol solution of thymol, naphthalene,  $\alpha$  naphthol, and 6N sulphuric acid (21 hours), is fatal to air-dried rice, whereas dessicated rice is harmed only slightly or not at all. Similar results are observed when maize is treated with commercial absolute ethyl alcohol, absolute ethyl alcohol solution of naphthalene (1 %), resorcin (5 %),  $\alpha$  naphthol (5 %),  $\alpha$  naphthylamine (10 %), 6 N sulphuric acid and hydrochloric acid.

The greater resistance of dessicated grain is also observed when the grain is cut in hay so that the embryo is covered only by a thin layer of endosperm.

The increased resistance of the dessicated seed may be due to 3 possible causes: a) an increase in the protective action of the selective permeable septum; b) an increase in the filtering power of the endosperm tissue; c) an increase in the stability of the plasm of the embryo.

2) The selective permeability of the tegument probably has its seat in a layer of cutinized cells immediately overlying the aleurone.

3) OH and H ions have no stimulating effect on the germination of rice, as is shown by the following table.

(1) See B. April, 1915, No. 365.

(2) Ordinary crushed quartz contains fluorine and gives up silica.

(Ed.)

(Author)



Liquids in which grains were steeped	Length of seedlings after 4 days
	mm
Caustic soda (NaOH) N/50	less than 1.0
" " " N/100	1.4
" " " N/1000	10.0
Tap water	9.9
Distilled water	15.0

The greatest development is found in distilled water.

4) Soaked rice grains germinate by inter-molecular respiration in an atmosphere of hydrogen gas, or in air from which the oxygen has been removed by potassium pyrogallate. In the absence of oxygen only the plumule develops, never the radicle. The different behaviour of the plumule and radicle is shown by the following results of an experiment in which the grains were kept for 48 hours in water and then exposed to the air.

	Growth in length mm.	
	first 48 hrs. in water	next 24 hrs. in air
Root . . . . .	0.10	11.55
Shoot . . . . .	10.55	2.60

5) The germinative power of rice and maize grains was unaffected by steeping for not less than 6 hours in liquid air. On the other hand, exposure to a high temperature (97-98° C) for 2 hours has a different effect on maize and rice; maize completely loses its germinative power, but rice, especially if dessicated, is only slightly affected.

717 - **The Influence of Water and Mineral Matter on the Germination of Peas.** — MA

• QUENNE, I. and DEMOUSSY E., in *Comptes rendus des séances de l'Académie des Sciences*, Vol. 164, No. 26, pp. 979-985. Paris, June 25, 1917.

In all investigations on the relationship between germination and growth and mineral matter (1) excessive quantities of these substances have always been used, except in the case of toxins. For this reason the authors again took up this study using smaller quantities. They also recognised that certain useful elements have as powerful an action as some of the strongest toxins, the influence of calcium, for example, being felt in dilutions of some hundred-millionths only.

In order to ascertain these effects a certain number of precaution must be observed; chief among these is the use of pure water.

The re-distillation of commercial distilled water in glass, and, still more, its sterilisation in glass in the autoclave, must be avoided because the glass is attacked by the water, which then contains solutions of salts. However small the quantity of such salts may be it is still too great (8 to 10 mgr. per litre by the 1st. method, a quantity 50 times as great as that in which it begins to be active; 40 to 50 mgr. per litre in the 2nd. method.)

(1) Amongst others Mlle. THÉRÈSE ROBERT's remarkable *Thèse de la Faculté des Sciences de Paris*, 1915. (Author).



It is this action on the glass which is the chief cause of the fact, observed by M. MOLLIARD, that seed germinates less well in water which has already been used for one or two germinations than in fresh water distilled and sterilised in the glass. This is due to the fact that the salts resulting from the action of the water on glass have been absorbed by the first seeds (1). This does not occur if pure water in quartz tubes is used. If the seeds (peas) are germinated directly in pure water of a depth of from 4 to 5 mm. in quartz dishes, the inverse phenomenon results: each culture is superior to the previous one by reason of the mineral and organic extracts given up to the water through the medium of the seed-coats.

For the same reason, seedlings not to be grown out in germinating dishes should be put, not in glass, but in quartz vessels as, in this case, the roots and even the stems grow better when exposed to the light.

Very different and very variable results are obtained according to the kind of glass used, the method by which it has been treated and the shape and capacity of the vessel as this modifies the surface contact with the water.

In their investigations, the authors excluded all glass vessels and used only quartz ones and, as germinating dishes, well glazed porcelain. The results obtained were comparable and very constant. The necessary water was obtained by distilling copper-free spring water twice consecutively in a large Jena retort connected, without joints or corks, to a transparent quartz condenser. 250 cc. of such water, reduced by evaporation to two drops, should cause no trouble either with ammonium oxalate or barium chloride. Only an unavoidable trace, from 1 to 2 hundred-millionths, of organic matter is found. The best way of estimating the purity of the water is to germinate seeds in it both when uncondensed and when condensed to a tenth; the results should be almost the same. This water should be kept free from dust in quartz or platinum vessels.

Germination in water only in quartz or glazed porcelain dishes was found unsatisfactory on account of the contamination of the water by the seed-coats. As substratum the authors used quartz, finely boiled with nitrohydrochloric acid, washed with pure water, then heated in platinum. In the absence of quartz, Fontainebleau sand similarly purified by nitrohydrochloric acid and calcined was used.

When several seeds are placed in the same substratum, care must be taken that the roots do not touch either the neighbouring seeds or the glass cover of the dish.

In their experiments the authors used peas of the variety known as *grey winter peas*.

In order to avoid any modification of the elements within their coats by contact with the antiseptics, the seeds were not sterilised, but thoroughly washed by being well-shaken with pure water.

After being soaked in pure water for 24 hours, the seeds were placed in groups of 10 either in quartz dishes or saucers, carefully washed with nitric acid and half-filled with moist sand (40 gr. of sand and 9 to 10 cc. of pure

(1) M. MOLLIARD admitted that this was due to toxins.

(Author).

water or salt solution). The dishes were covered with glass and kept in a dark cupboard at a temperature of from 20 to 25° C. Only the roots were studied. These were measured after 6 days, when their growth is completely stopped in pure water.

Below is given the length of the roots taken under the above-mentioned conditions in pure water. Each figure represents an average of 20 measurements, so that the general average corresponds to 200 separate observations.

*Length of roots after 24 hours' soaking and 6 days' germination: series of 10 seeds. 26 mm.; 23 mm.; 30 mm.; 25 mm.; 26 mm.; 27 mm.; 24 mm.; 27 mm.; 26 mm.; 25 mm.; General average: — 26 mm.*

These greatly reduced measurements are in agreement with those noticed when similar seeds are grown in pure water in quartz tubes and exposed to the light. Even under these more advantageous conditions the roots of the peas hardly exceed 35 mm. in length, whereas, in glass tubes they may reach a length of 50 mm., and even as much as 70 or 80 mm. when distilled water is used in the glass tubes.

In pure water, growth stops on the 3rd. or 4th. day, the main root remains smooth and rootlets are rare and usually absent. The general appearance is that of a stunted plant quite different from that of plants grown in ordinary distilled water, which always contains a little lime.

The authors are not of the opinion that pure water has a toxic action, but believe that it is merely insufficient to maintain the metabolism of germination.

The salts removed from ordinary glass by water are composed, chiefly of a mixture of alkaline silicates and calcium sulphate, and the authors' experiments show that only the calcium has any action. This brings out a new function of this metal, misunderstood up to the present because the culture media have been insufficiently purified, that of influencing growth when present in infinitesimal quantities.

718 — “Giovanni Raineri” and “Emilio Maraini”, New Varieties of Autumn Barley Selected in Italy. — STRAMPELLI, NAZARENO, in *L'Italia Agricola*, Year 54, No. 5, pp. 208-209 + 1 plate; No. 6, p. 240 + 1 plate. Piacenza, May 15 and June 15, 1917.

Since 1911, studies in the selection and hybridisation of barley have been carried out in the experimental plots in the Leonessa plateau (Province of Aquila). Over 300 varieties were obtained, two of which proved very productive, and were called “Giovanni Raineri” and “Emilio Maraini”. They are illustrated by two plates and described as follows:

“GIOVANNI RAINERI” BARLEY. — Average height of the plant 90-100 cm: *culm* strong, resistant to lodging, curved at the top; *ears* six-rowed, average length about 10 cm., about 80 grains per ear; *glumes* narrow, almost parallel, ending in small, thin awns of a maximum length of 15 mm.; *pale* not very thick; the outer side of the pale has, on its lateral veins, a row of very small teeth; *awns* of average length, 15.66 cm.; the *pale* and *spikelet axes* have long, shiny, silky hairs; *grain* of average size: 7 mm. ×



3.1 mm.  $\times$  2.5 mm., mealy, containing 68.5 % starch and 8.1 % protein ; 1000 weigh 50.17 gr.

The composition of this barley and its thick pale make it suitable for brewing. At Leonessa it gave during the last 4 years an average yield of 1 ton per acre, with a minimum of 0.71 tons in 1915 and a maximum of 1.55 tons in 1914.

This barley does fairly well even in Apulia, but it is really best adapted to central and northern Italy, especially to hilly and mountainous districts. It should always be sown early in autumn.

"EMILIO MARAINI" BARLEY. — *Culm* strong, of an average height of 65-70 cm.; *ears* six-rowed, with an average length of 4.5 cm.; average number of grains per ear 70; *glumes* fairly narrow, lance-shaped, ending in fine awns 19 to 20 mm. long; *pale* very small, with long, silky hairs, fairly thick, with series of small teeth on the lateral veins down almost the whole length of the outer side; *awns* average length about 12 cm.; *grains* glutinous, containing 67.03 % starch and 9.40 % protein, average measurements  $8 \times 3.7 \times 2.9$  mm., weighing 48 gr. per thousand.

During the last 5 years this barley gave at Leonessa an average yield of 0.98 tons per acre, with a maximum of 1.31 in 1912 and a minimum of 0.77 tons in 1915.

It resists drought well and when grown at Foggia gave better results than "Giovanni Raineri" barley; in a dry year it yielded 0.55 tons per acre.

#### 719 — Observations on the Inheritance of Anthocyan Pigment in Paddy Varieties. —

HECTOR, G. P., in *Memoirs of the Department of Agriculture in India, Botanical Series*, Vol. VIII, No. 2, pp. 89-101 + II plates. Calcutta, November, 1916.

A considerable proportion of the paddy varieties grown in India are characterised by the presence of reddish and purplish pigment distributed throughout various parts of the plant. In this connection, the plants studied may be divided into 4 groups.

- 1) Leaf-sheath, apiculus of glumes, and stigma coloured.
- 2) Leaf-sheath and apiculus of glumes coloured; stigma colourless (white).
- 3) Apiculus of glumes and stigma coloured, leaf-sheath colourless.
- 4) Apiculus of glumes only coloured.

Group 1 is the commonest; groups 2, 3 and 4 contain comparatively few individuals. GRAHAM observed that all plants with a coloured leaf-sheath (red or purple) have an apiculus of the same colour; this led him to believe that the converse may also be true and that, in groups 3 and 4, not only the apiculus is coloured, but also the leaf-sheath, but so slightly that the colour is hard to detect. The stigma, on the other hand, is independent of the leaf sheath and apiculus, and though these are coloured, the stigma may be either colourless, of the same shade or darker.

The most important results of this study may be summarised as follows: 1) In 1912, 48 natural crosses characterised by the presence of red pigment in the leaf-sheath were isolated. In 1913 the  $F_2$  generation was composed of red and green individuals in the approximate ratio of 9:7.



If **R** be considered the factor which, in presence of a chromogen base **c**, produces the red colour, it may be supposed that the coloured parent was of the constitution **CR** and the green (colourless) **cr**. The formula of the  $F_1$  hybrid will then be **Rr Cc**, and the  $F_2$  plants will have the following constitutions: — 9 **RC** (red); 3 **Re** (green); 3 **Cr** (green); 1 **cr** (green); i. e. a ratio of 9 red: 7 green. This would give 4 kinds of reds — **RRCC**, **RrCc**, **RrCC**, **RR Cc**— and would explain the different shades of red observed in coloured members of the  $F_2$ .

2) In a few cases the simple ratio 3 : 1 has been obtained. In 1913 crosses were made between a wholly green variety (Pookhi), and a variety with a purple stigma and red leaf-sheath and apiculus (Pankhiraj). The  $F_1$  plants (1914) showed the colour characters almost wholly dominant. The  $F_1$  plants (1915) were distributed as follows :

	Coloured leaf-sheath apiculus and stigma	Colour- less	Ratio
No. 1 Pookhi ♀ × Pankhiraj ♂	67	30	2.2 : 1
No. 2 " × "	200	67	2.9 : 1
No. 3 " × "	267	69	2.8 : 1
No. 4 " × "	116	30	3.8 : 1
No. 5 Pankhiraj ♀ × Pookhi ♂	365	121	3.0 : 1
Total . . .	1 015	317	3.2 : 1

The colour in the leaf-sheath, apiculus and stigma behaves as a single unit and may be due to one single factor.

3) The author found that the purple colour frequently present in the stigma does not correspond to the colour of the leaf-sheath and apiculus, and is due, not to two factors **R** and **C**, but rather to the simultaneous action of 3 factors, **R**, **C** and **P**, the last of which is found in the stigma only.

$F_1$  plants, with red leaf-sheaths, red apiculus and blue-black stigmas, gave, in  $F_2$ , plants with coloured and with white stigmas in the ratio 437 : 665. Assuming that the  $F_1$  hybrids have the formula **Cc Rr Pp** they will, on selfing, give plants of the following constitution.

Number	Constitution	Stigma	Leaf-sheath	Apiculus
27	<b>CRP</b>	coloured	red	red
9	<b>CR</b>	white	"	"
9	<b>PR</b>	"	green	green
9	<b>CP</b>	"	"	"
3	<b>R</b>	"	"	"
3	<b>C</b>	"	"	"
3	<b>P</b>	"	"	"
1	<b>crp</b>	"	"	"

The ratio between plants with coloured and with white stigmas is, therefore, 27 : 37, or 1 : 1.3. The colour in the stigma would thus appear to be due to the presence of 3 independent factors, **R**, **C** and **P**, and the phenomena of the distribution and transmission of pigments in rice may be explained by Mendelian laws.

720 - On Cultural Bud Mutations of some Species of *Solanum* and on the Acclimatization in France of some Bolivian Species. — VERNE, CLAUDE, in *Comptes rendus des Séances de l'Académie d'Agriculture de France*, Vol. 3, No. 23, pp. 637-642. Paris, June 20th. 1917.

I. CULTURAL BUD MUTATIONS. — In this paper the author gives the results of experiments carried out in 1914-1915-1916 in collaboration with M. GINET. The work was undertaken in order to substitute for the old species younger and more productive new ones, more resistant to disease. The tests were made in various soils, at different altitudes and under varying climatic conditions. No definite data on the influence of altitude were obtained, and the results given concern only the nature of the soil and the climate.

Interesting results were obtained at Montmelas (Rhône), in the Ain district, at Bourg d'Oisans (Isère), and at Sisteron (Lower Alps), but the most important work was done at Gières (Isère). The author reported the following new species to the Academy of Agriculture.

4. 1. — *Solanum Maglia*, set at Gières in 1913, gave numerous long, semi-cylindrical average tubers with a fine, smooth, reddish-violet skin. The growth of the plant still leaves something to be desired, but it improves each year. It has stiff stems from 1 to 1 1/4 feet high which have not yet flowered. It is an early species.

4. 2. — *S. Maglia*, set at St. Martin d'Uriage in 1914. This plant is one of the finest obtained. Slender at first, it is now thick and leafy; the leaves, which have grown considerably, have changed from light to dark green and have taken an upward curve; the flower is still white, but is much larger, and the petals firmly joined. The tubers have increased in weight from 5 gr. to 185 gr., their colour has changed from light violet to pink; they are clustered at the foot of the stalk, in sufficiently large numbers for the plant to be classed as very fertile and fairly early. The flesh of the tubers is white, sweet and succulent; the inner pinkish skin colours the outer smooth, transparent skin. No traces of disease have as yet been found on the plant or tubers.

27. 1. — *S. Commersoni*, set at Gières in 1913. Mutation, light yellow, fertile and early; plant vigorous, of a lightish green colour, straight, stiff stalks; tubers large (255 gr.) round or oval, sometimes indented, tasty, ripening all together at the end of July.

27. 2. — *S. Commersoni*, set at Gières in 1913. Of medium strength, leaves grained; flowers rotate, pale violet, variegated; tubers long, indented, with smooth, fairly fine skin.

27. 3. — *S. Commersoni*, set at Gières in 1914. Similar to the preceding.

27. 4. — *S. Commersoni*, set at St. Martin in 1914 and since grown at Gières. Plant low, spreading, thick, with pale violet stalks, dark green leaves, white, rotate flowers; tubers numerous, large and pale yellow. A very fertile and very strong species.

27. 5. — *S. Commersoni*, set at Sisteron in 1915.

27. 6. — *S. Commersoni*, set at Montmelas in 1916.

II. BOLIVIAN SPECIES BROUGHT TO FRANCE IN 1911. — *Lac Viticaca*



(Naqui, altitude = 12 120 feet). Plant strong, straight, reaching a height of 6  $\frac{1}{2}$  feet; flowers lavender-coloured on a long, jointed and branching stalk; tubers round, dark brown, skin violet inside and black outside, flesh white and most tasty of all; never any sign of disease of the aerial parts; tubers keep perfectly.

*Papa-Amarillas* (La Paz, altitude = 11 828 feet). Plant fairly vigorous, of similar appearance to the preceding; foliage light green, flowers pale lavender; tubers round, pinkish-brown, variegated. Quality, keeping powers and resistance similar to the preceding species.

*Ymill-imilla* (Province of Ullona, altitude = 12 364 feet). — Plant straight, very strong though slightly slender, capable of reaching a height of 5 feet, foliage pale green, flowers white; tubers round, pale pink, small, but numerous and very healthy.

721 - **Thirty-seven Years of Spruce Selection, in Austria.** — REUSS, in *Centralblatt für das gesamte Forstwesen*, Year 42, Pts. 11-12, pp. 383-417. Vienna, November-December, 1916.

The results given in this paper are a continuation of those published in the same journal in February and April, 1884. The first of the 3 series of experiments, carried out in 1878 on the Colloredo-Mannsfeld estates at Dobrish, Bohemia, was undertaken to study the duration of the germination of spruce seed. Only the course of germination and its results till the period when the seedling becomes physiologically independent were included. The second series dealt with the maturation period of the seed, and, consequently, included sowing, germination and the care of the plant till, at 4 years, it is set in the plantation. The third series concerns the "puberty" of the plant (period at which the trees begin to bear fruit), and the influence of the age of the tree on the quality of the seeds from the point of view of pure selection, and had, therefore, to be continued from the first stage till the age for felling was reached. This series of experiments of 37 years was carried out constantly under the personal supervision of the author; it is now being continued by the Imperial Forestry Experiment Institute at Mariabrunn. The present paper gives the results obtained up to the present and a brief summary of those published in 1884.

The experiments in pure selection were made with 21 kinds (classes) of spruce seed taken from controlled plants varying between the ages of 23 and 142. The results showed that, as a rule, the size of the seeds decreases with the age of the parent plant, and that small seeds predominate in trees of more than 46 years. The results obtained led to no definite proof that the age of the tree has any influence on the germinating energy (Keimkraft) of the seed; nearly all the classes reached the highest germinating percentage in the 5th. and 6th. week, but the energy during this time was totally different.

The experimental plants, 18 000 in round figures, were planted at the age of 4 years in an area of about 8  $\frac{1}{2}$  acres, in the spring of 1883.

The weight, length of the roots, strength and height of 15 plants of each class were previously taken. These figures showed the average growth and were published in table form in the first paper. They show an astonish-



ing irregularity and diversity, but, as a rule, the oldest trees appear to give the highest yields. The age of the tree seems to have no influence on the mortality of the seedlings, or if there is any such influence, it is subordinate to other causes. Generally speaking, the percentage of plants that die increases with the age of the stock plant.

In 1899, when the plantations were beginning to develop, a census of the experimental plots was taken. During the summers of 1889 and 1890, when the annual growth was over, the trees were counted, the individual and the average height taken and tabulated. These figures throw no clear light on the influence of the age of the tree on the value of the seed from the point of view of selection and growing capacity. The percentage of losses for the years 1888 and 1890, and the data on the growing capacity are given in graph form.

In the autumn of 1916 the average diameter was calculated in each plantation; the diameter of the base of the trunk was also determined: 1) for the number of trunks present, 2) as average per tree, 3) for the unit-number of 100 trunks, which, with the exception of one plot, represents the minimum and could therefore, be used for comparison. Sections were taken at breast height from the felled trees, and, from these was calculated the strength of the wood in 1904, i. e. in its 25th. year.

The results of the 2nd. series of experiments, from 1889 to 1916, are summarised as follows:

1) Neither the observations, measurements, calculations nor data obtained since 1884, nor the condition of the experimental plots, now 37 years old, give any definite information with regard to the influence of the age of the stock plant on any of the biological phenomena and on the growth of the progeny. On the contrary, external factors (quality of the soil, thickness, formation of clumps, etc.) have the greatest influence on growth in all the trees examined. Only a comparison of the greatest differences of age shows that an old stock plant has a favourable influence on the growth of the progeny until the maximum limit for felling is reached, and that, from that moment, the influence is unfavourable.

2) This does not apply to growth in height which seems much more sensible to environmental difference than growth in thickness. Growth in height becomes gradually less in proportion as the age of the parent-plant increases, but no trustworthy explanation of this phenomenon can be found in the habitat. The control experiments, obviously carried out under unfavourable environmental conditions give opposite results — the growth in height of the progeny increases with the age of the stock-plant. The series of experiments ends with trees of 120 years.

3) The individuality and internal constitution, rather than the age of the stock plant seem to influence the growth of the progeny. The graphs constructed from all the average values obtained from calculations and measurements show a remarkable analogy with the curves constructed from the figures given in the tables. This analogy shows the prominence of the peculiarities of the parent plant in its descendants.

4) Seeds of plants from different altitudes show, in many directions,

a different behaviour in the development of the descendants and confirm Prof. CIESLAR'S theory of "climatic varieties".

In studying the theory of heredity, special attention was given to the two varieties, red-coned *Picea excelsa* var. *erythrocarpa* (early or red spruce) and the green-coned *P. excelsa* var. *chlorocarpa* (late or white spruce) because it has frequently been stated that the latter variety would facilitate the destruction of *Liparis monaca*. A study was also made to see whether early and late spruce seeds are constant with regard to their characters, and whether it would be possible to grow plantations of the late varieties, or, at least, to cultivate them in conformity with the object in view. The author calls "individually constant" the colour which returns regularly each year on the same plant and the peculiarity of an early start in growth in the red-coned variety, and a late start in the green-coned variety.

The *chlorocarpa* or *erythrocarpa* varieties cannot be grown immediately in pure plantations with any certainty that the seed is constant, but, by careful selection, either of these varieties may be satisfactorily grown. The period of growth and the colour of the cones vary and are influenced by cross-fertilisation. While the stock form of the mother plant predominates in the progeny, the other form also occurs in proportion as the female or male cell has an equal or superior power.

The risks from late frosts are very much reduced though not completely eliminated in a late-flowering variety even if there is a difference of 14 days only. Nevertheless, the mere fact of reducing the dangers from frost repays the trouble taken to grow many late varieties in spruce plantations. By the lateness of their period of vegetation such trees impede the birth and growth of the larvae of *Liparis monaca*, and thus present a further advantage.

The late start of growth in spring also prolongs by 14 days the possibility of using the *chlorocarpa* variety for the cultivation of plants. Moreover, by reason of its narrow, rounded crown, this form is less liable to be broken by snow and is more resistant to weather.

Determinations of the specific weight of sections taken at breast height showed that the technical properties of the wood are not influenced to any vital extent by the age of the parent plant.

722 - *Musa paradisiaca* s. sp. *seminifera* in Banana Selection. — See No. 730 of this Bulletin.

723 - **Fall-Sown Grains in Maryland and Virginia.** — STANTON, I. R., in *United States Department of Agriculture, Farmer's Bulletin* 786, 23 pp., 6 figs. Washington, D. C., February, 1917.

This bulletin contains a description of agricultural methods and procedures concerning winter cereals based on experiments carried out in these two states and intended for the use of practical agriculturists. The following have proved the most satisfactory varieties for these states :

WHEAT: 1) *bearded* : Dietz, Fulcaster, Gipsy, Rudy, Stoner ; 2) *beardless* ; China, Currell (Currell Prolific), Fultz, Leap (Leap Prolific), Poole, Purple Straw, Dawson (Dawson Golden Chaff).



RYE: Abruzzis, Giant Winter, Virginia Winter.

SPELT: Alstroum, Red Awnless.

OATS: Culberson, Red Rustproof, Winter Turf.

BARLEY: Tennessee Winter, Union Winter.

- 724- **Belotourka, Richelle and Oregon, Good Varieties of Wheat for Chili.** — FROMM-HERZ, HERIBERTO, in *Boletín de la Sociedad agrícola del Sur*, Vol. XVII, No. 2, pp. 14-15. Concepción (Chili), March-April, 1917.

Numerous varieties of wheat have been tested at the Santiago Agricultural Station of Chili. Those which gave the best quantitative and qualitative results were Belotourka, White Naples Richelle and Oregon, which yielded respectively 4280 lbs., 3224 lbs. and 3 226 lbs. per acre.

The two first varieties were but slightly attacked by rust ("polvillo"), the third suffered from attacks of "polvillo colorado".

Private farmers also made very successful experiments on a small scale with these wheats.

The Santiago Agricultural Station recommends Belotourka for the central valley and secondary valley of the O' Higgins Province, in the north; white Richelle for dry or irrigated soils, especially those of Santiago, in the south; Oregon for irrigated soils all over Chili.

- 725- **Experiments in Oat-Growing in the North of Sweden.** — RHODIN, SIGURD, in *Kungl. Landbruks Akademiens Handlingar och Tidskrift*, No. 2, pp. 150-160. Stockholm, 1917.

This paper contains the results of many experiments on 4 varieties of oats, Björn, Orion, Mesdag and Nordfinsk (black) carried out from 1913 to 1915 in two different districts — the Stockholm University agricultural experiment field and the Robertsfors farms, in the north of Umeå, beyond the 64th. degree of northern latitude.

These 4 early varieties have a very short vegetative cycle and, even though sown late, ripen before the early autumn frosts put an end to all plant growth. Sowing is usually a month later at Robertsfors than at Stockholm; the respective dates for the 3 years of the experiment were:

	Stockholm	Robertsfors
1913 . . . . .	May 6 th.	June 4th.
1914 . . . . .	April 29th.	June 9th.
1915 . . . . .	April 30th.	June 5th.

**YIELD IN GRAIN.** — The Orion variety gave the best results, both at Stockholm and at Robertsfors, as the following relative indices show:

	Stockholm		Robertsfors
Orion . . . . .	100.0	Orion . . . . .	100.0
Björn . . . . .	98.5	Nordfinsk . . . . .	92.9
Mesdag . . . . .	94.3	Mesdag . . . . .	92.4
Nordfinsk . . . . .	93.2	Björn . . . . .	98.7

During the 6 years 1911-1916, the Orion variety gave, at Robertsfors, an average of 2504 lbs. per acre; it is, therefore, the most satisfactory for the cold Norrland regions.



**YIELD IN STRAW.** — The Orion variety again leads with an average yield of 6459 lbs. per acre for the years 1911-1916. A high yield in straw is a distinct advantage when early autumn cold prevents the grain from ripening, because the large fodder harvest obtained by cutting the oats partly compensates for the loss of grain. A comparison between Orion and the other varieties gave the following relative indices:

	Stockholm		Robertsfors
Orion . . . . .	100.0	Orion . . . . .	100.0
Björn . . . . .	91.3	Nordfinsk . . . . .	95.2
Nordfinsk . . . . .	88.3	Mesdag . . . . .	89.8
Mesdag . . . . .	82.5	Björn . . . . .	82.7

In both yield of straw and in yield of grain the Björn variety, which holds the 2nd. place at Stockholm, only holds the 4th. at Robertsfors.

**DURATION OF VEGETATIVE CYCLE.** — The data obtained at Robertsfors for the periods 1913-1915 and 1911-16 are given below:

	1913-1915	1911-1916
	days	days
Mesdag . . . . .	95.3	94.6
Björn . . . . .	96.0	95.3
Nordfinsk . . . . .	97.3	97.5
Orion . . . . .	98.0	97.1

These 4 varieties are, therefore, very early and are suited to the most northern latitudes in which oats are grown.

**726 - Leguminous Crops in Desert Agriculture.** — HOWARD, C. and HOWARD, G. I. C. in *The Agricultural Journal of India*, Vol. XII, Part 1. pp. 27-43. Calcutta, January 1917.

The development of Indian agriculture is largely a problem of increasing the production of the soil. This increase in production includes the conquest of the desert by means of irrigation. Irrigation alone, however, is not sufficient as the deficiency of desert soil in organic matter soon results in poor crops. As green manuring — the obvious remedy — does not appeal to the cultivator, the problem is to find a way by which the organic content of these desert soils can be increased, and at the same time be profitable.

The solution is to be found in the extended growth of leguminous fodder-crops like *shaftal* (*Trifolium*), lucerne, *berseem* (*T. alexandrinum*), *senji* (*Melilotus indica* and *M. alba*), and *guár* (*Cyamopsis psoraloides*, D.C.), which are largely grown for green fodder round the towns of North-West India. But the area under these fodder crops falls off, as there is little sale for the green fodder and no proper methods of drying and storage exist. Once a method of drying and baling these fodder is found together with a market for the produce, the cultivation of these crops will develop rapidly to the benefit both of the soil and the cultivator, the nitrogen-fixing properties of leguminous crops being well known. Again, the extended growth

of these crops will benefit the efficiency of the ox, which is very low because of the lack of nutritious food, the working cattle being given food with too low an albuminoid ratio. This defect can be considerably obviated by the use of properly dried and stored leguminous crops — *shaftal*, lucerne, *berseem* or *senji*. Analyses of these fodders show a high albuminoid ratio ranging from 1 : 3 to 1 : 4. Feeding trials on Army horses at Quetta showed that working animals like horses and mules thrive on comparatively small amounts of such fodder.

During the last few years, a considerable amount of attention has been paid at Quetta both to the enrichment of the desert soil with organic matter by the growth of leguminous crops and also to the best methods of drying and baling the produce. This has opened the way to the development of improved animal production and the building up of a new and profitable industry for supplying baled leguminous fodders for Army purposes and for ordinary working cattle. The present paper deals with the progress made in these matters up to the end of 1916.

*The Drying and Baling of Leguminous Fodders.* — The two most suitable leguminous fodders for growth in the upland frontier valleys appear to be Persian clover or *shaftal* (1) and lucerne. The former is an annual which should be sown in early September and which gives as many as 6 cuts before dying down after flowering in June. Lucerne is perennial, but ceases to be profitable in the Quetta valley after five or six years.

In Baluchistan, both *shaftal* and lucerne do best on manured land, but the former does much better than lucerne as a fresh crop on poor land. After taking *shaftal* crops for 2 or 3 years, the land is fit for growing lucerne.

The annual yield of green *shaftal* on land in fairly good condition near Quetta is high, being over 33 tons to the acre in 1915-16, giving a value of Rs. 371 an acre.

These fodders should both be cut as often as possible so as to obtain the most nutritious fodder and the maximum yield. Drying should be conducted very carefully, the retention of sufficient moisture in the dried product having to be provided for. Overdrying causes loss of the valuable leaves and consequent reduction of food value. Drying should be carried out in stages. *Shaftal* dries much more slowly than lucerne, and after cutting should be spread out to dry for a day or two, then turned and left another day. It is then collected into heaps and pressed down firmly to check the rate of drying. If done at the right time, a slight fermentation begins and on the second day the fodder begins to be slightly warm. The heaps are now opened and spread out to dry off excess moisture, taking care not to overdry. After remaining a few days in heaps the fodder can either be stacked or else baled at once. Lucerne should be collected into heaps on the third day, and then the heaps opened out once or twice afterwards. Once it is dry enough it should be baled immediately as it dries very rapidly in the stack.

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(1) The cultivation of *shaftal* is dealt with in detail in the *Agricultural Journal of India*. Vol. XI, No. 1, 1916.

The preparation of the baled fodder requires some capital and is therefore beyond the means of the ordinary cultivator. It should, therefore, be carried out at centres where ample supplies of green fodder can be produced and where there is little competition for the available supplies such as exists in large towns and military cantonments. A few miles out of the town, however, the conditions are different and the establishment of baling stations would be sure to lead to the extension of *shaftal* and lucerne cultivation for baling purposes only. The type of bale produced should conform to the local requirements. In Baluchistan, *shaftal* baling is carried on from March till early June, and lucerne baling comes in May and lasts till October.

*The Feeding value of Shaftal and Lucerne Hay.* — The *shaftal* and lucerne hay prepared at Quetta are equal to the very best grades of these fodders made in Europe. Analyses at Pusa showed that they had the following composition :

*Composition of shaftal and lucerne hay at Quetta.*

	Shaftal (in bales)	Lucerne (in bales)
Moisture . . . . .	15.86	3.14
Oil . . . . .	2.19	3.32
Albuminoids . . . . .	14.10	15.48
Soluble carbohydrates . . . . .	39.98	46.30
Woody fibre . . . . .	13.80	17.70
Soluble mineral matter . . . . .	12.88	11.83
Sand . . . . .	1.19	2.23
<i>Total</i>	100.00	100.00
Total nitrogen . . . . .	2.48	2.98
Albuminoid nitrogen . . . . .	2.26	2.48
Albuminoid ratio . . . . .	1 : 3.2	1 : 3.5

These fodders are evidently too concentrated for use by themselves. Feeding trials with Army mules and horses showed that a ration composed of equal parts of *bhusa* (1) and *shaftal* hay, with an albuminoid ratio of 1 : 5, was suitable in every respect. For light work, it was found that the proportion of *bhusa* could be increased. A ration consisting of 2 parts of *bhusa* to 1 part of *shaftal* hay would give food with an albuminoid ratio of 1 : 6.2 which would keep horses, mules and cattle in ordinary work in good condition without the addition of grain. For Army purposes, the

(1) *bhusa* = chopped wheat straw of the assumed composition of fats 0.98 %, albuminoids 3.01 % and soluble carbohydrates 37.93 %.

(Ed.).



substitution of *shaftal* or lucerne hay for grain as the main albuminoid carried together with the reduction of the amount of *bhusa* would lead to a great reduction of weight as far as transport work is concerned.

*Leguminous Fodders in India.* It will be seen that a sure market is required for the successful spread of leguminous fodders in North-West India. For this end, if the Army largely adopts them their success is certain. Further, these fodders will enrich the soil and improve the efficiency of both working and milk cattle, as well as being invaluable for famine reserves. The land would then be more intensively and widely cultivated and would in addition, support a larger population. The nitrogen-fixing leguminous fodder crops can effect all this, provided that the market is secured.

727 - **Effect of Inoculation on Growth of Lucerne and Lupin.** — See No. 713 of this *Bulletin*.

728 - **Factors Causing Variation in the Yield of Camphor in the Florida Camphor Tree.** — HOOD, S. C., in *The Journal of Industrial and Engineering Chemistry*, Vol. 9, No. 6, pp. 552-555. Boston, Pa., June, 1917.

RUBBER, GUM  
AND  
RESIN PLANTS,  
ETC.

In view of the recent increase in the commercial cultivation of the camphor tree (*Laurus Camphora*) in Florida the author gives full details of the various factors on which depend the yield in camphor of the leaves and twigs of the tree, and, at the same time, takes full account of the difference in the methods employed in Florida, Japan and Formosa. The data are based on observations made in Florida between 1907 and 1912 on camphor trees grown under varying conditions.

These observations show that the highest yield of camphor is obtained from the leaves and twigs of the last growth taken during dormant season; if on the other hand, these are left on the plant for another season, the yield is decreased. The yield of the young wood is very slight and has no importance from an economic point of view. Vigorous pruning, giving rise to a profuse growth, causes a low yield from the leaves and twigs and a very slight formation of camphor in the wood. On the other hand, clipping the leaves and branches as is done for hedges tends to increase the camphor yield of subsequent harvests. In order to put a plantation to the most economical and practical use, the maximum quantity of high-yielding leaves and twigs, with the minimum quantity of woody parts, should be obtained. Care should be taken not to wound the plants in any way. The slightest shade is deleterious to the camphor tree and tends to diminish the percentage of camphor in the leaves, diminishing at the same time the leaf surface of the plant.

Varying climatic conditions and rainfall cause marked annual variations. Moreover, since the yield in camphor depends largely on the growth, forcing gives a larger quantity of richer gum-yielding material.

The highest percentages of camphor were obtained from the best soils, particularly from heavy loam, whereas they showed a marked decrease in proportion as the soil became lighter and more sandy. Exceptions to this rule were observed in very poor soil, where the plants were stunted, and contained a fairly high percentage of camphor in their leaves.

FRUIT  
GROWING

729 - **The Acreage of Fruits, Bearing and Non-bearing, by Counties, in 1916 in California.**—WELDON, G. P., in *The Monthly Bulletin of State Commission of Horticulture*, Vol. VI, Nos. 3-4, pp. 115-117. Sacramento, California, March and April, 1917.

There are, in the service of the Californian Horticultural Commission, 47 county commissioners who supply accurate details concerning the development of fruit-growing in their respective counties.

The following figures are abstracted from the table given by the author, referring to the area occupied by fruit trees in each county. Only the total figures for California are given below.

*Acreage of fruit-orchards in California during the year 1916.*

	Total area 798 007 acres	
	Bearing	Non-bearing
	(acres)	(acres)
Almonds . . . . .	20 476	20 052
Apples . . . . .	39 602	22 150
Apricots . . . . .	77 977	18 739
Berries . . . . .	15 953	765
Cherries . . . . .	8 240	5 244
Figs . . . . .	7 397	3 475
Lemons . . . . .	21 946	17 773
Olives . . . . .	16 114	12 091
Oranges . . . . .	113 729	57 256
Peaches . . . . .	82 834	25 137
Pears . . . . .	18 039	22 285
Plums . . . . .	16 436	6 369
Prunes . . . . .	101 190	30 214
Walnuts . . . . .	35 384	22 366

730 - **An Edible Seed-Bearing Banana for Temperate Climates.**—ROBERTSON, PROSCHOWSKY A., in *La Petite Revue agricole et horticole*, Year 23, No. 535, p. 101. Antibes, July 8, 1917.

In his Botanical Garden ("Les Tropiques", St. Helena, near Nice), the author has a banana tree which has been identified as *Musa paradisiaca* L., sub-species *M. seminiifera* (Lour.) Baker.

This plant forms a cluster of 23 ft. and is very fine; its resistance to weather is rather greater than that of the non-seed-bearing sub-species *M. paradisiaca* s. sp. *sapientum*. The under side of the young leaves is a purple-red, which disappears as the leaves reach their full growth. The floral stem bears 11 to 14 flowers per hand instead of 8; the fruit is only a third, or, at the most, half the size of those of ordinary banana trees and, when ripe, remains green or turns very slightly yellow. The fruit, though it cannot be compared with that of the usual cultivated tree, is fairly fleshy, very sweet and pleasant to the taste, and perfectly edible.

This banana-tree did not suffer from last year's cold and snow. Its resistance could certainly be increased by selection of the plants obtained

from the seed ; it might also be possible, by selection, to obtain trees with few seeds and a more pleasant taste so as to form varieties well suited to temperate climates. Hybridisation would prove interesting, especially with *M. Cavendishii* Lamb.

731 - Notes on Hybrid Direct Bearers in the Seine-et-Marne District, France. — SA-  
LOMON, R., in the *Revue de Viticulture*, Year 24, Vol. 44, No. 1176, pp. 25-30 ; No. 1181,  
pp. 105-108. Paris, January 11 and February 15, 1917.

VINE GROWING

I. — RESISTANCE TO MILDEW. — The work, carried out in the experi-  
mental fields in the Seine-et-Marne district, dealt only with early varie-  
ties during their first period of maturity and second early period. Five  
vines were planted in a position facing east, cold, chalky, exposed to frost,  
and, from midday, over-shadowed by high trees ; that is to say, all the con-  
ditions were highly favourable to the growth of *Peronospora*. The inves-  
tigation was carried out during 6 years, dating from the first harvest. The  
direct bearers always benefited by the first treatment of the viniferas, so  
that each year, immunity was perfect. Nevertheless, in 1910 and 1915,  
when mildew was exceedingly prevalent, certain hybrids proved not to  
be immune and were removed. The following varieties proved immune  
both as regards fruit and leaf mildew.

*Baco* : 24-23 No. 1, 22 A, 43-23 ; — *Castel* : 2 528, 3 343, 4 001, 8 930, 16 525, 19 002 ;  
— *Couderc* : 106-51, 146-51, 251-150, 272-60, 28-112, 7 103, 7 104, 7 105, 7 120, J 503, called  
*Oiseau bleu*, 4 401, called *Oiseau rouge dit La Madone* ; — *Gaillard-Girerd* : 2, 157, 194 ;  
— *Oberlin* : 595, 663, 782 ; — *Seibel* : 117, 128, 131, 156, 181, 782, 802, 845, 1 000, 1 077, 2 004,  
2 006, 2 010, 2 620, 2 719, 2 734, 2 793, 2 828, 2 834.

FERTILITY. — The following were found particularly fertile :

*Baco* : 22 A, 24-23 No. 1, 43-23 ; — *Castel* : 2 528, 4 001, 16 525, 19 002 ; — *Couderc* :  
7 103, 7 106, 7 120 ; — *Oberlin* : 595. — *Seibel* : 782, 131 (the strength of this plant leaves  
something to be desired, it should be grafted on to stronger stocks).

ALCOHOL CONTENT : As regard alcohol content, density tests led to  
the following classification :

*Gaillard-Girerd* 194 — 11°. — *Castel* 2 528 and *Oberlin* 595 — 10°. — *Baco* 24-23 No. 1 and  
*Castel* 19 002 — 9 ½° — *Gaillard-Girerd* 157, *Oberlin* 663 and 782, *Sibel* 2 719 — 9°. — *Baco*  
22 A and 43-23, *Gaillard-Girerd* N. 2 — 8 ½° — *Castel* 3 343, *Couderc* 106-51, J 503, 4 401 —  
8° strong. All the others vary between 6° and 8°.

#### PRACTICAL CLASSIFICATION.

1) *Baco* 24-23 No 1 ; 2) *Gaillard-Girerd* 2 ; 3) *Seibel* 2 834 ; 4) *Castel* 3 343 ; 5) *Oberlin* 595 ;  
6) *Couderc* 7 106 ; 7) *Couderc* 7 120 ; 8) *Couderc* 7 104 ; 9) *Couderc* 7 103 ; 10) *Seibel* 2 010 ;  
11) *Gaillard-Girerd* 194 ; 12) *Gaillard-Girerd* 157 ; 13) *Castel* 16 525 ; 14) *Couderc* 4 401 ;  
15) *Sibel* 131.

Then come :

*Baco* : 22 A and 43-23 ; *Castel* : 2 528, 4 001, 8 930, 19 002 ; *Couderc* : 106-51, 272-60,  
28-112 ; *Oberlin* : 663, 782 ; *Oiseau bleu* (J 503) ; *Seibel* : 181, 845, 1 000, 2 006, 2 719, 2 793, 2 828,

And, lastly :

*Couderc* : 146-51, 251-150 ; *Seibel* : 117, 128, 156, 187, 782, 802, 1 077, 2 004, 2 620, 2 734.



VINIFICATION. — Numerous vinification tests proved that, for all these direct bearers, better wine is obtained if mixed varieties are used in the vat. In order to obtain a good new wine with perfect keeping properties, it is advisable to mix the following varieties during vinification :

1) Red wine : — *Baco* 24-23 No. 1 and *Oberlin* 595 ; any of the other red-wine bearers may be mixed, the more numerous they are, the better will be the wine ;

2) White wine : — *Gaillard-Girerd* 157 and *Oberlin* 782 alone make a complete wine ; *Baco* 22 A and 42-23, *Castel* 19002 (pink), *Couderc* 146-51, 251-150, 272-60 are improved by being mixed as soon as they have left the press, and thus give a good table wine.

RESISTANCE TO PHYLLOXERA. — This was not studied directly by the author as his vineyard was in a district which is still immune. Nevertheless, by reason of the information he has been able to obtain, he feels justified in stating that ungrafted direct bearers may be planted in *Riparia* (i. e. light) soils, whereas in all others it is preferable to plant them grafted. The hybrids *Oberlin* 595, 663 and 782, *Baco* 24-32 No. 1 may be excepted on account of their great resistance.

RESISTANCE TO LIME. — In soils containing more than 15 % lime it is wise to plant direct bearers on suitable stocks.

The following may be planted ungrafted :

1) *Oberlin* 595, 663, 782 ; *Baco* 24-23 No. 1, in all soils containing up to 70 % of lime of average harmfulness ; 2) *Gaillard-Girerd* No. 2, all soils up to 25 % of this lime ; 3) *Couderc* 272-60, J. 503, all soils up to 25 to 30 % of this lime ; 4) *Couderc* 146-51, all soils up to 15 % of this lime ; 5) *Baco* 22 A, 42-23 ; *Castel* 2 528, 3 343 ; 4 001 ; 8 930 ; 16 525, 19 002 ; *Couderc*, 106-51, 251-150, 28-112, 4 401 ; *Gaillard-Girerd* 157, 194 ; *Seibel* 128, 131, 156, 782, 802, 845, 1 000, 1 077, 2 004, 2 006, 2 010, 2 719, 2 743, 2 793, 2 828, 2 834, in all soils with a content of harmful lime not exceeding 12 to 15 % ; 6) *Couderc* 7 103, 7 104, 7 106, insufficiently resistant to phylloxera and must always be used grafted.

Grafted direct bearers are *direct scions* ; they have a great affinity for *americano-americans*, but most of them are do well with *franco-americans*.

II. — In 1916 the author noticed that some of his direct bearers, which had hitherto proved interesting, did not give satisfaction for one or more of the following reasons : insufficient resistance to mildew, oidium or rot, mediocre or total absence of fertility. Among the bearers mentioned above the following may be considered unsatisfactory :

1) White grape hybrid : — *Baco* 43-23.

2) Black-grape hybrid : — *Seibel* 117, 2793 ; *Couderc* 28-112.

RESISTANCE TO DROPPING. — 1) Total resistance :

White : *Baco* 22-A ; *Bertille Seyve* 450 ; *Couderc* 146-51, 251-150 ; *Seibel* 845, 2 875. — Black : *Baco* 24-23 No. 1 ; *Bertille-Seyve* 822, *Castel* 2 528, 4 001 ; *Couderc* 106-51, J. 503, 7 103, 7 104, 7 120. *Hybride Fournié* ; *Seibel* 117, 121, 128, 131, 156, 782, 1 077, 2 004 ; 2 006, 2 010, 2 734, 2 828, 4 576.

2) Dropping slightly :

White : *Castel* 19 002 (pink) ; *Gaillard-Girerd* 157. — Black : *Bertille-Seyve* 413, 453 ; *Castel* 8 930 ; *Couderc* 7 106 ; *Seibel* 181, 2 620, 2 719, 2 834.

## 3) Clusters with two-thirds of normal fruit :

White: *Couderc* 272-60; *Seibel* 2 661. — Black: *Gaillard-Girerd* 19A; *Oberlin* 595.

## 4) Clusters with equal numbers of normal and dropped fruit :

White: *Baco* 43-23; *Oberlin* 782; *Seibel* 880. — Black: *Castel* 3 343; *Couderc* 4 401; *Gaillard-Girerd* No. 2.

## 5) Clusters with two-thirds of dropped fruit and one-third of normal fruit : •

Black: — *Castel* 16 525; *Seibel* 187, 735, 2 793.

## 6) All fruit dropping :

Black: — *Seibel* 802, 2828.

## RESISTANCE TO OIDIUM: — 1) Immunity without treatment :

White: *Baco* 22 A; *Bertille-Seyve* 450; *Castel* 19 002 (pink); *Gaillard-Girerd* 157; *Couderc* 146-51, 251-150, 272-60; *Oberlin* 782; *Seibel* 845, 880. — Black: *Baco* 24-23 No. 1; *Bertille-Seyve* 413, 453, 822; *Castel* 2 528, 4 001, 8 930, 16 525, *Couderc* J. 503, 106-51, 7 104, 7 106.

*Hybride Fournié*; *Gaillard-Girerd* 2, 194; *Oberlin* 595, 663; *Seibel* 117, 121, 128, 131, 156, 181, 187, 782, 1 077, 2 004, 2 006, 2 010, 2 620, 2 719, 2 734, 2 793, 2 834, 4 576.

## 2) Very slightly attacked :

Black: *Couderc* 4 401, 7 103, 7 120; *Seibel* 735.

## 3) Slightly attacked :

White: *Baco* 43-23; *Seibel* 2 661. — Black: *Castel* 3 343.

RESISTANCE TO BOTRYTIS CINEREA. — All the direct bearers mentioned above as resistant to dropping and to oidium, are also totally resistant to grey rot.

CONCLUSIONS: — The author states that the above facts concerning direct bearers apply in every respect to his vineyard, but that it is very difficult to adapt these vines to new surroundings, so that a grower, before adopting direct bearers should test at least 10 of them in an experimental plot.

732 — **The Contribution of Forestry to the Problem of Public Nutrition during the War, in Germany.** — BORGMANN, in *Tharandter Forstliches Jahrbuch*, Vol. 67, Pt. 6-7, pp. 367-456. Berlin, 1916.

FORESTRY

The contribution of forestry to nutrition in war time has been developed from two different bases: 1) to furnish a plan by which the various problems pertaining to the desired end may be solved in order of their importance and urgency; 2) while using the forests for the necessities of war to protect them as much as possible against excessive demands which would harm their permanent utility. These problems may be summed up as follows:

## I. The gathering of fruit and mushrooms :

1) Products of plants growing near the earth: 1) berries: — bilberries, whortleberries, cranberries, marsh bilberries, strawberries, raspberries, blackberries; 2) mushrooms; *Boletus edulis*, field mushroom, *Cantharellus cibarius*, *Agaricus virescens*, *Agaricus prunulus*, *Boletus*, *Agaricus ruber*, *Morchella esculenta*, etc.

2) Shrub fruit : sorb-apple, arbutus, barberry, hawthorn, sloe, wild rose, juniper, medlar, cornel, etc.

II. The gathering of medicinal plants and tea substitutes.

III. The products of oil yielding trees :

1) The cultivation of colza in oak clearings, cultivation of sunflower and poppy in the woods ;

2) Harvest of beechnuts ;

3) Harvest of other oil-yielding fruits : walnuts, hazelnuts, horse-chestnut, lime seeds and spruce seeds.

3) Potato to be replaced in the production of alcohol by wood and by residuary waters containing sulphite from the manufacture of cellulose.

VI. The use of wood and residuary waters containing sulphite from the manufacture of cellulose in the production of alcohol.

VII. The use of wood residuary waters containing sulphite and tree-leaves in the production of sugar.

VII. Grazing in the woods, the utilisation of grass and leaves, the utilisation of twigs as fodder.

VIII. Litter of dead leaves and peat.

IX. Cultivation of intercrops and peat-moss.

X. The killing of game, protection against the damage caused by game, and the feeding of game in war-time.

Only a few of these problems have been solved ; most of them are still under consideration. A circular, dated June 27 th., 1916, concerning the gathering of berries and mushrooms, has been issued by the President of the Food Control Department. Public institutes have also published illustrated instructions regarding the gathering of mushrooms, botanical excursions have been arranged, exhibitions and information bureaux opened, etc. In some districts the price of these products has risen so much that it is very desirable that they should be lowered. The encouragement of the gathering of shrub-fruit has been left completely to local institutions. This also applies to medicinal plants and tea substitutes (leaves of woodruff, bramble, strawberry, raspberry, wild pansy, various species of *Vaccinium*, wild rose, willow, willow herb, elm, poplar, hawthorn, elder, cherry, sorb-apple, maple, birch, etc. ; flowers of lime, elder, camomile, etc.).

Of 1 093 436 acres of copse in Germany 642 486 acres are available for the cultivation of colza, and, of these, 86 488 acres could be used in the present season. All colza seed has been requisitioned and, in return, facilities have been granted for obtaining colza cake. The author then gives details for the cultivation of colza. For the year 1916, about 4 942 acres were prepared, but no definite results will be obtained till harvest time. The cultivation of sunflowers is still in the experimental phase, that of poppies can only be undertaken in good, well sheltered soils.

As regards the beechnut harvest, the following scheme has been drawn up :



Forest area of Germany . . . . .	34 595 400 acres
Area under beech-woods . . . . .	4 447 980 "
Area under nut-bearing beech, 1916 . . . . .	2 965 320 "
Area under nut-bearing beech over 100 years old . . . . .	494 220 "
Area under beech available for use (50 % of the preceding area) . . . . .	247 110 "
Yield in beech nuts from this area . . . . .	491 071 tons
Oil yield . . . . .	2 200 000 gallons
Cake produced . . . . .	24 505 tons

The cost of oil production may be placed at about 3 *Marks* (3s. at par) per litre.

An order has been issued by the Federal Council and two circulars by the President of the Food Control Department concerning the utilisation of beechnuts as a foodstuff in war time in Germany and the occupied territories. The author has published an appeal, and the war Committee for Oils and Fats has distributed printed instructions on the subject.

There are few walnuts or hazelnuts in Germany. Horse-chestnuts yield about 5 % of oil, the utilisation of which is still being studied. Experiments showed lime seeds to give a yield of only 2.5 % on crushing, whereas previous analyses gave their oil content as 18.25 % and even 58 %, doubtless extracted with the help of solvents. The oil yield of sorb-seeds is also too low. Spruce seeds, on the other hand, give 25 % of oil. Experiments on the value of the cakes as cattle food are still in progress. However, if it is assumed that there are 6 177 750 acres of spruce in Germany, and that, 49 422 acres are felled annually, calculating 68 bushels of cones per acre there would be a yield of 55 020 bushels of cones, to which must be added 687 750 from the harvest from standing trees. Reckoning that 1.2 lbs. of seed are obtained per bushel of cones, there will be a yield of 393 tons of seed giving 98 tons of oil at 5.40 *Marks* (1) per litre.

If the greater part of the beechnuts is used for oil production and cakes, acorns and horse-chestnuts are left for use as cattle food. The use of these has been regulated by a federal order and their sale is controlled by the Sales Union of German Farmers. The price fixed is 190 *Marks* per ton for dried acorns and 150 *Marks* per ton for dried horse-chestnuts. It would be possible to extract oil from the horse-chestnuts for the manufacture of cakes. The War Food Bureau has issued an appeal for the harvest of these two products.

The production of wood meal as a foodstuff will soon be realised. A factory for this purpose is connected with the eastern army headquarters at Souvalki; there are two factories using STEFFEN'S method, and another being built which will use WINDHEIM, TEN DORCAAT and CLASSEN'S method. The War Committee for Cattle Food Substitutes controls the use of this meal.

The use of meal made from heather, dried and freed from its woody parts, and also lichen (*Cetraria islandica* and *Cladonia rangiferina*), has been

(1) 1 Mark = 1 s. at par.

proposed. The former has a value equal to that of average hay; the latter may also be used for human nutrition.

The progress made in the utilisation of wood and sulphite-containing residuary waters from the manufacture of cellulose has allowed a large quantity of potatoes to be freed for human and animal nutrition. It has also been proposed to use the sulphite-containing residuary waters as animal foodstuff. These waters may also be used for the commercial production of sweetened solutions, and, in the same way as infusions of tree-leaves, for the production of fat and albumin by means of cultures of *Endomyces vernalis*.

It is advisable to enclose wood pasture-land. Though the use of grass and leaves as fodder has been considered by the Federal Council and by the author, there is, for the moment, no need to use twigs as fodder.

Dead leaves and peat may be used as litter. The growing of cereals; especially rye, maize and broad beans, as intercrops in the woods is under consideration. The cultivation of the peat-beds has been intensified with the help of prisoners of war.

The most satisfactory way of preventing damage by game is to kill it. This, however, must be restricted so that the number of game in the woods shall not be unduly limited, as, in this case, the loss would exceed the gains. Game represents 0.5 % of the meat supply, and, even if it were all killed, this figure would only be increased two or three times. Nevertheless, an order of the Federal Council has fixed maximum prices for game, and another allows the netting of thrushes. The importance of not neglecting the feeding of game, even in war time, is insisted on, so that this source of food may be maintained. In order to keep the game healthy, mixed foods should be supplied at the beginning of winter. Five groups of food are recommended for this purpose.

## LIVE STOCK AND BREEDING.

### HYGIENE OF LIVESTOCK

733 - Notes on Some Animal Parasites in British Guiana.—BODKIN, G. E. and CLEARE, L. D., in the *Bulletin of Entomological Research*, Vol. VII, Pt. II, pp. 179-190, fig. 3, 1 plate. London, October, 1916.

The following species are noted and a short description of each given :

#### VERMES.

1) NEMATODA : a) FILARIDAE : *Filaria cervina*, Duj. on a cow; *F. physalura*, Bremser, on a large bird of common occurrence, the Collared Kingfisher (*Ceryle torquata*); *F. immitis*, Leidy, very common on creole dogs, who do not seem to suffer from it, or only to a very slight extent, the mosquito (*Culex fatigans*) is probably the propagator of this parasite. *F. sp.*, on a White-breasted Swallow (*Tachycineta albiventris*).

b) ASCARIDAE : *Ascaris megaloccephala*, Cloquet, on a horse.

c) STONGYLIDAE : *Ankylostoma sp.*, on dogs; *Physaloptera? praeputialis*, Linst. on cats.

2) PLATYHELMINTHES : *Dicorcelium sp.*, very common on cats.

3) CESTODA : *Moniezia expansa*, Rud, on pigs.

4) ACANTHOCEPHALA : *Echinorynchus gigas*, Goeze, on pigs.



## ARACHNIDA.

**ACARINI : IXODIDAE :** In British Guiana all kinds of live stock are attacked by various species of ticks, which are in many cases responsible for a very considerable annual financial loss. The animals are not dipped, nor are any other preventive measures taken. *Argas persicus* Wald., in fowl-houses, *Rhipicephalus sanguineus*, Latr. found in all its stages of development on dogs; *Margaropus annulatus*, var. *australis*, Fuller, on all cattle; *Amblyomma cajennense*, F., a parasite of man; *A. humerale* Koch, on turtles; *A. dissimile*, Koch, a common parasite of the ordinary toad (*Bufo marinus*), and sometimes found on lizards and snakes.

## HEXAPODA.

1) **DIPTERA :** a) **TABANIDAE :** In the coastal region Tabanidae occur frequently, usually in large numbers of a few common species. In the forest area, however, the coast-land species seldom occur, but there are many others, some of which are comparatively rare. The savannah lands near the Brazilian border are particularly rich in Tabanidae, but this district has not yet been closely investigated. The most common species which attack live-stock on the coastal region are: *Tabanus trilineatus*, Latr., possibly the commonest and most widely distributed (it is also found in forest regions); it does not attack man and is attracted by artificial "light"; *T. senior*, Wlk.; *T. semisordidus* Wlk.; *T. trifasciata*, Wlk.; *T. desertus*, Wlk.

*Tabanus senior*, Wlk. and *T. semisordidus*, Wlk. are much alike in appearance and habits; they attack all kinds of stock but have never been observed to attack human beings. *T. impressus*, Wied. is widely distributed and has been known to attack man. It has been impossible to determine the feeding habits of *T. desertus*, Wlk. *T. caiennensis*, T., is a parasite of stock occasionally found near the coast; it is common in some of the interior districts and readily attacks man. *T. leucaspis*, Wied. occurs rarely within the forest area, where it has been observed to attack man. *T. ochroleucus*, Mg. is attracted to houses by artificial light and attacks man. A specimen of *T. oculus* Wlk. was taken in the interior districts while attacking man.

*Dicranomyia cervus*, Wied., is not uncommon in some of the interior districts and readily attacks man.

*Chrysops tristis*, T., is widely distributed round the coast and occasionally found in the forest district. *C. costata*, F., only met with in certain districts where the soil is of a sandy nature and near large stretches of fresh water; like *C. tristis* it attacks man. *C. fulviceps*, Wlk. seems to be found in the forest districts only. Specimens of *Bolbodimyia bicolor*, Big, and *Lelidoselaga crassipes*, F. were taken while attacking man.

At certain times of the year *Diachlorus scutellatus*, Macq., *D. podagricus*, F., and *D. curvipes*, F. are extremely abundant and most obnoxious owing to their persistent attacks on man. They inhabit the forest regions, especially those near the rivers in the north-west district.

*Dichelacera damicornis*, F. and *D. testacea*, Macq. are found in the forest districts and readily attack man.

The chief enemies of Tabanidae are large wasps of the Bembecinae family. The commonest species of these found on the coast are: *Monedula signata*, Latr., *M. punctata*, Lep. and *M. surinamensis*, Dahlb., while, in the forest region, *M. pantherina*, Handl. is common. In this last district, *Bembidula discisa*, Tasch. and *B. variegata*, Oliv. are also found. The Asilid fly *Mallophora calidus* F. is also an occasional enemy of Tabanidae in the coastal area.

A recent outbreak of *Trypanosoma equinum* ("Mal de Caderas") amongst sugar plantation mules was most probably propagated by biting flies, for most of the common species of Tabanidae and other biting flies, such as *Stomoxys calcitrans*, L. were observed on the diseased mules. *S. calcitrans* is common in the coastal area and in many of the inhabited inland regions. In the absence of other hosts it readily attacks human beings.

b) **ANTHOMYIDAE** — *Mydaea pici*, Macq., whose larvae are subcutaneous parasites of birds.



c) MUSCIDAE. — *Stomoxys calcitrans*, L. L. (see above).

d) HIPPOBOSCIDAE. — A large number of these are known to attack birds; among them *Lynchia maura*, Big. is common on domestic pigeons.

2) SIPHONAPTERA: a) SARCOPSYLLIDAE: *Dermatophilus penetrans*, L. is widely distributed throughout the colony.

b) PULICIDAE: *Ctenocephalus felis*, Bch., very common on cats and dogs and occasionally attacks man.

3) RHYNCHOTA. — CIMICIDAE: *Cimex hemiptera*, F. (*rotundatus*, Sign.)

4) ANOPLURA. — a) PEDICULIDAE: *Pediculus capitis*, de Geel; *P. humanus*, L.; *Phthirus pubis* L.

b) HAEMATOPINIDAE: *Haematopinus eurysternus*, Nitzsch., is the common cattle louse; *H. tuberculatus*, Nitzsch., found only on imported Indian buffaloes; *H. suis*, L. very common on pigs.

5) MALLOPHAGA: a) TRICHODECTIDAE: *Trichodectes pilosus*, Gieb., on the donkey; *T. climax*, N., on the goat; *T. sphaerocephalum*, N., on sheep.

b) PHILOPTERIDAE: *Philopterus breviformis*, Kell. and Kuw.; *Ph. duplicatus*, Piag; *Ph. obscurus* Gieb; *Degeeriella* sp.; *Paragoniotes abnormis*, Kell.; all parasites of various species of birds.

c) GONIODIDAE: *Goniocotes curtus*, N., on a species of pheasant; *G. gigas*, Taschb. (= *abdominalis*, P.), on chickens and turkeys; *G. hologaster* N., on pigeons and guinea-fowls, *G. dissimilis* N., on chickens and turkeys; *G. compar*, N., on pigeons; *G. pavonis*, L., on the peacock; *G. styliifer*, N. on turkeys.

d) LIPEURIDAE. — *Lipecurus assessor*, Gieb.; *L. baculus*, N., *L. leucopygus*, N., *L. polytrapezius*, N.; *L. squalidus*, N.; *L. variabilis*, N.; on various species of birds, domestic or otherwise.

e) MENOPONIDAE: *Menacanthus* spp.; *Menopon biserialatum*, P.; *M. pallidum*, N.; *M. macropus*, Gieb; *Myrsidea rustica*, N.; *Colpocephalum dissimile*, Piag.; *C. maculatum*, Piag. *C. phaeostomum*, N.; 3 other undetermined species of *Colpocephalum*, parasites on various species of wild and domestic birds.

f) PHYSOSTOMIDAE: *Physostomum angulatum*, Kell. and Ph. sp. on birds.

g) LAEMOBOTHRIDAE: *Laemobothrium opisthocomi*, Cummings and L. sp., on birds.

h) GYROPIDAE: *Gyropus ovalis*, N. and *Gliricola gracilis*, N.; on guinea-pigs.

734—Mercury Compounds in the Treatment of Epizootic Lymphangitis (1). — FINZI GUIDO, in *Bulletin de la Société de Pathologie exotique*, Vol. X, No. 6, pp. 428-430. Paris, June, 1917.

In January 1916, the author, having 5 horses in his stables suffering from a very serious form of epizootic lymphangitis, made a test on them of a new method of treatment which gave perfectly satisfactory results.

G. GASPARINI had previously recorded a case of cure of a young colt which was suffering from a serious form of epizootic lymphangitis, obtained with bichloride of mercury employed in the same way as in syphilis.

The present writer has experimented with this and with other forms of mercury treatment:

a) Salicylate of mercury . . . . .	6 gr.
Sterilised vaseline oil . . . . .	100 "
b) Calomel . . . . .	5 gr.
Sterilised vaseline oil . . . . .	100 "
c) Bichloride of mercury . . . . .	1 gr.
Sodium chloride . . . . .	2 "
Boiled distilled water . . . . .	100 "

(1) See B. June 1917, No. 561.

(Ed.)

Finally, he has tried a fourth formula *d*) an arsenious-mercuric association, based on the results obtained in certain infectious diseases with a mixed treatment :

<i>d</i> ) Benzoate of mercury . . . . .	1 gr.
Sodium chloride . . . . .	0.26 "
Cacodilic acid . . . . .	0.50 "
Boiled distilled water . . . . .	100 "

The two first solutions were injected endomuscularly and the remaining two both hypodermically and endomuscularly.

With the last formula two horses have been treated and cured.

The treatment, as is usually with all mercuric treatments, should be applied with care. If signs of mercuric poisoning occur, the treatment must be suspended, oil purgatives administered and treatment recommenced 8 to 10 days later, or, if there has been kidney trouble, as soon as albumen has disappeared from the urine.

The animals were cured after 10 to 12 injections.

The writer considers himself justified in stating that mercurial treatments for epizootic lymphangitis are the best, both from the economic point of view and from the point of view of result..

The cure was complete and no relapse has been observed in any case.

Formulae *c*) and *d*) gave the quickest cures.

735 - **Ulcerative Stomatitis in Horses.** — RÈNE, CH., in *Le Progrès agricole*, 31st. year, No. 1537, p. 311. Amiens, July 1, 1917.

Ulcerative stomatitis has practically only been recorded in France on army horses, but owing to its great contagiousness is quite capable of spreading to other horses. It seems to have been introduced from abroad.

The symptoms of this complaint are very similar to those of thrush in cattle, although the two diseases are distinct: profuse saliva and difficulty in chewing at the beginning; lesions of the membranes of lips, mouth and tongue; in places the mucous membranes seem to be covered with a crusty exudate of an inflammatory nature; small sores round the lips and usually on the tongue as well (often an ulcer as big as the palm of the hand appears upon the tongue); in short, lesions, confluent or otherwise, resembling those of the mouth cavity of cattle suffering from thrush.

Contrary to what takes place in thrush, no lesions have been recorded from the foot region, the disease does not touch ruminants nor pigs and appears to be a local complaint, taking its course without causing fever.

The cause of the complaint is not yet known: it has been attributed to the irritant or toxic action of certain fodder plants but this has not been definitely established.

Ulcerative stomatitis is extremely contagious and is spread by horses drinking from a common trough, being stabled together etc.

The infection is not serious: it requires about 10 days to run its course, the lesions remain localised and the damaged consists in the affected animals losing flesh owing to difficulty in chewing and swallowing.



*Treatment* : liberal washing out of the mouth cavity with water containing honey and vinegar or slightly salt, or with weak solutions of potassium permanganate (1 gr. per 20 litres of water ; feeding with bran or flour mashes or young grass ; isolation of the sick horses ; each horse should have its own recipient for water and food. It might be advisable sometimes to effect voluntary contamination.

**736- Rabies and Haemorrhagic Septicaemia in some Young Buffaloes, in Italy. —**

MORI, NELLO, in *La Clinica Veterinaria*, Year XI, No. 7, pp. 177-191; No. 8, pp. 211-223.

Milan, April 15 and 30, 1917.

In December 1910 and January 1911, a group of young buffaloes (kept separate from the adult males and only brought to the mothers to suck) of the Aversano farm, in the commune of Battipaglia (Salerno), were found to be suffering from a disease, whose symptoms related almost exclusively to the nervous system, and which had not been previously observed in that region. Four young buffaloes died of the disease. Some days previously, the stockmen had killed two dogs showing signs of hydrophobia.

The two last young buffaloes that died showed no anatomical lesions under the autopsy that were worthy of note ; their heads were sent to the writer to diagnose the disease. The examination was carried out at the Experimental Station for infectious diseases of cattle at Portici (Naples).

By inoculating a series of rabbits, it was established that the cause of death was rabies, a disease not previously recorded for the buffalo. The incubation period for rabies in the buffalo was not established.

The observed symptoms, although similar to those of cattle rabies, do not appear to be referable to hydrophobia virus, as they could be reproduced experimentally by inoculating the toxins obtained from the brains of buffaloes or rabbits, or produced in cultures *in vitro* of the pathogenic organism isolated from the brain of the buffaloes, or from cultures *in vitro* of the typical *Bacillus bubalisepticus*, although in this case the symptoms were less serious. It appears that, in the buffaloes in question, the progress of the disease had been checked by an infection due to *B. bubalisepticus*. The secondary infection by this organism does not seem strange in a disease caused by a filterable virus ; since in another disease caused by this virus (strangles, swine fever, equine influenza, aphtha), secondary invasions of organisms causing haemorrhagic septicaemia are seen. On the other hand it appears new in relation to the virus of rabies. As is well known, *B. bubalisepticus* is fairly common on buffalo breeding farms and is found in the latent state in the digestive tracts of these animals. In the case in question, the virus of rabies, besides preparing the way for the invasion of *B. bubalisepticus*, would have overcome the resistance to the above organism presented by young buffaloes during the period of feeding by the mother, possibly through temporary immunisation conferred by the maternal milk. All the mothers have certainly contracted *pasteurellosis* as calves, the disease appearing to confer immunity for the rest of the life.

Although the buffalo calves had sucked during the disease, there were no cases of transmission of rabies to the mothers or other calves ; this



appears to be due to the fact that the rabies was checked in its progress before the saliva could have become virulent.

737 - **Studies on Contagious Agalaxy of Goats in Algeria.** — SERGENT, EDM. and ROIG, G., in *Bulletin de la Société de Pathologie Exotique*, Vol. X, No. 7, pp. 575-585. Paris, July 11, 1917.

The work was carried out at the Pasteur Institute of Algeria.

On the 28th. April, 1908, the author was called in to examine, in the neighbourhood of Algiers, a herd of about 450 goats, of which, in a week, about 60 mothers and a few he-goats had been attacked by contagious agalaxy. Three or four kids died each day. On July 15th., 19 goats and 105 kids died. Ten years ago another case of agalaxy among goats was noticed by BANGUIL, formerly head of the Algerian Veterinary Sanitary Service, in the Guergour and Kerrata districts. It is certain that these epidemics are not frequent as, for ten years, the author has been unable to trace any others, and veterinary delegates state they have never seen one in Algeria.

During the infection of 1908 there was always present in the pure milk a bacterium, cultures of which produced no symptoms of the disease when inoculated. It was thus a proof of the invisible specific virus discovered by CELLI and DE BLASI in 1906. In its characteristics this micro-organism is related to PREISZ-NOCARD'S heterogenous group. Bacteria of the same group are found in various serious diseases of sheep. Their pathogenic action is not clear.

DESCRIPTION OF THE EPIDEMIC : 1) *Effect on kids* : almost complete loss of appetite, limbs drawn in under the body ; head slightly stretched forward ; hair almost bristling ; sometimes the kid falls in convulsions ; death usually occurs on the 2nd, 3rd. or 4th. day ; the temperature rarely exceeds 40°C. Sometimes during the development of the symptoms the animals limp badly. Post mortem results always negative.

2) *Effect on adults.* — They are affected much less than the kids. The general symptoms are more vague ; the disease always appears in its chronic form. There is gradual loss of appetite ; temperature varies between 38.9° and 39.2°C.

The lesions always appear on the udder ; sometimes the udder and one joint are attacked simultaneously. The udder becomes inflamed ; milk secretion decreases ; the milk on standing separates into two distinct parts ; the lower part ( $\frac{1}{3}$  or  $\frac{1}{2}$ , sometimes  $\frac{2}{3}$  of the volume) is formed of a dirty white deposit ; the upper part (usually  $\frac{2}{3}$  of the volume) is dirty white, sometimes reddish. The milk gives an alkaline reaction, coagulates at 100°C. and, at the same temperature, coagulates normal milk ; it keeps these properties after being passed through a CHAMBERLAND F. filter. After about 15 days, milk secretion stops completely. Abortion sometimes occurs. Post mortem examinations give negative results.

EXPERIMENTAL STUDY. -- Attempts were made to reproduce the disease in goats experimentally by : 1) inoculation of milk (in the udder, peritoneum, subcutaneously) ; 2) ingestion of milk ; 3) blood inoculation ; 4) infection through contact. Guinea-pigs and rats were also inoculated with the milk.

The results led to the following conclusions :

CONCLUSIONS . -- The Algerian epidemic of 1908 was remarkable for its suddenness and violence. In 3 months it killed 124 goats out of 450 (27.5 %), especially attacking young animals.

In the natural disease, mammary lesions always occur, lesions of the joints frequently occur, lesions of the eye have never been observed. Non-milking animals, therefore, only show lesions of the joints.

In the experimental disease, lesion of the udder and joints are always present ; lesions of the eye have been noticed in 2 cases out of 13.

The disease was not transmitted by inoculation of the blood of infected animals ; vaccination did not confer immunity.

Inoculation with the milk (subcutaneously or in the peritoneum) produces the disease in goats without fail. Intraperitoneal inoculation does not affect either the guinea-pig or the rat.

The virus is not weakened by passage through the body.

The ingestion of infected milk does not give the disease.

One goat was infected by contact.

In the epidemic studied a polymorphous bacterium of the PREISZ-NOCARD group was always found in the milk, never in the blood.

Inoculation with cultures of this microorganism was not pathogenic.

This bacterium is doubtless a proof of the invisible virus discovered by CELLI and DANTE DE BLASI. It does not even appear to play the part filled by CARRE'S pyobacillus in Lure's disease. It simply appears to prove that the infection is caused by the specific virus.

738—**Studies in Milk Secretion.** — HAMMOND, J. and HAWK, J. C. (*School of Agriculture, Cambridge*) in *The Journal of Agricultural Science*, Vol. VIII, Part 2. — I. The Effect of Nutrition on Yield and Composition, pp. 139-146, 3 tables, 2 figs. — II. The Relation of the Glands of Internal Secretion to Milk Production, pp. 147-153, 5 tables.

I. — No definite principles have yet been established with regard to the effect of nourishment on milk production, notwithstanding the quantity of work done on this subject. The object of the present writers was to study the changes in the yield and composition of the milk which followed a sudden change in nutrition. These changes were effected by the administration of phloridzin together with the control of the food supply.

Well fed goats were used in all the experiments and care was taken that they had continual access to an abundant supply of water. They were milked regularly at different intervals three times a day ; records were kept of the yield at each milking in cc. and the percentage fat in each milking estimated by the GERBER method.

Three series of experiments were performed : a) food was withheld for a short time and then a plentiful supply given ; b) food was withheld, phloridzin (in alcohol) was injected and shortly afterwards a plentiful supply of food given ; c) phloridzin was injected into goats under perfectly normal conditions of feeding.

The results of the experiments were as follows :

As a result of withholding food for a few days, together with an injection of phloridzin, thereby reducing the nutrition, the daily yield of milk



in goats was diminished and in one case the flow was actually stopped. On giving food again the yield returned almost to normal within a few days.

As the daily yield of milk diminished under these conditions so the percentage of fat in the milk rose. Limitation of the available nutriment in the body (change from a high to low state of nutrition) did not reduce the percentage of lactose or protein in the milk (PATON and CATHCART) but reduced the quantity of milk (together with the amounts of protein, sugar and salts) produced. The secretion of fat was not at first affected by the change in metabolism and as a consequence milk rich in fat was produced.

The amount of fat secreted per day under these conditions of diminishing yield was, however, not constant but became reduced, possibly as a secondary effect of the decreased secretion taking place in the gland cells.

On again giving food to animals in such a reduced state of nutrition, the percentage of fat in the milk decreased as the yield increased, in some cases to such an extent that it was below that of the normal milk before the experiment began.

II. — It is now generally recognised that the glands of internal secretion play an important part in regulating the metabolism and so controlling the nutrition of the animal. The present experiments with pituitary extract and adrenalin were devised in order to test the relation of the glands of internal secretion to milk production.

*Pituitary Extract.* — The effect of pituitary extract was studied in animals under conditions of reduced nutrition, the conditions of the experiments being exactly as described in the first paper; see (a), (b) and (c) above. It is known from previous experiments that under normal conditions injections at intervals of one day give no immunizing effect, injections of 1 cc. at such intervals giving approximately the same amount of milk. The goats were milked dry each morning and immediately after 1 cc. of pituitary extract was injected. Since it has also been shown that the action of the extract was complete in less than half an hour after injection, the goats were milked after this period, and the amount obtained is taken as the yield resulting from pituitary injection. The percentage of fat in each sample was determined by GERBER's method. The following conclusions were reached:

The flow of milk produced as a result of an injection of pituitary extract varies with the state of nutrition of the injected animal.

This variation (due to nutrition) is not so great as that produced in the case of the morning or the daily yields, indicating that the action of the pituitary extract is on some more stable quantity (possibly some special store situated in the ducts and alveoli of the mammary gland).

The percentage fat of the pituitary milk is increased by the state of lowered nutrition in the same way as that of normal milk: .

*Adrenalin.* — The goats (three) were milked at definite times twice a day but in addition to this, injections of, on the average, 6 cc. of a  $\frac{1}{1000}$  solution of adrenalin chloride were made on alternate days after the morning milking, the goats being milked again at an interval of half an hour. On



the "normal" days, which alternated with the days on which adrenalin was given, the treatment was exactly the same except that sterilised water was injected in the place of adrenalin. It was so arranged that the day, for the purpose of computing the yield, started with an injection. The following table gives the average for all these experiments.

	cc. milk (12 days av.)		% fat. (8 days av.)		gm. fat. (8 days av.)	
	Adre- nalin	Nor- mal	Adre- nalin	Nor- mal	Adre- nalin	Nor- mal
Injection. . . .	19	20	7.9	7.6	1.5	1.5
Evening . . . .	122	172	5.5	5.2	6.7	9.1
Morning . . . .	388	452	4.1	3.5	16.3	15.8
Total . . . . .	527	643	4.6	4.0	24.5	26.4

The following are the conclusions :

Injections of adrenalin though resembling pituitary extract in causing hyperglycaemia differ from them in having no immediate action on milk secretion.

Injections of adrenalin have a secondary effect on milk secretion causing a decrease in the amount of milk produced for a period of a day following its injection.

The percentage of fat in the milk from the period following an injection of adrenalin is above normal, although the actual amount obtained is somewhat below normal.

The rate of the milk flow is very susceptible to changes in the metabolism of the animal.

#### HORSES

739 - **The By-Products of the Decortication of Rice ("pula vergine") as a Substitute for Wheat in Feeding Horses.**—GIULIANI, R., in *Minerva Agraria*, Year 9, Nos. 9-10, pp. 98-103. Milan, May 15-31, 1917.

As a continuation of his experiments on the use of the by-products of the decortication of rice in the feeding of dairy cows (1) the author carried out a feeding test on 10 horses, 5 experimental and 5 control, in order to determine: 1) if horses accept these by-products willingly and how they should be given; 2) if these by-products may be substituted for oats without reducing the live weight and working capacity of the horses; 3) to what extent such a substitution is advisable; 4) the economic advantage of such substitution; 5) the method of preserving these by-products.

The experiment lasted 66 days, including a preparatory period of 6 days during which the horses were accustomed to the by-products, and 5 periods of 12 days each, varied by a progressive increase in by-products and decrease in oats.

The experiment was made with by-products obtained by the blanching and polishing of rice, with oats and with hay. The chemical composition of the feeding-stuff was as follows:

(1) See *B.* January 1917, No. 56.

TABLE I. — *Chemical Composition of the Food Stuffs Used.*

	By-products of Rice —	Oats —	Hay —
Moisture . . . . .	15.60 %	12.55 %	11.60 %
Crude protein . . . . .	11.55	9.95	6.55
Crude fat . . . . .	13.60	4.50	2.05
Fibre . . . . .	9.00	9.35	21.70
Nitrogen-free extract . . .	40.10	60.55	51.34
Ash. . . . .	10.15	3.10	6.76
Digestible protein . . . .	8.90	9.00	4.25

The determination of digestibility (by KELLNER's tables) and the food value, expressed in kilograms (1) of starch, of one quintal of by-products of rice, of oats, and of hay, showed that, theoretically, 1 kg. of oats equals in food value 0.931 kg. of rice by-products. In order to make the substitution more practical, it was assumed that 1 kg. of oats corresponds to 1 kg. of rice by-products.

Before the experiment the horses received 3.5 kg. of hay, 4.2 kg. of oats and 1.2 kg. of straw. This ration was also fed to the 5 control animals. The experimental horses received successively in the 5 periods respectively 1, 1.5, 2, 2.5 and 3 kg. of rice by-products, 3.2, 2.7, 2.2, 1.7 and 1.2 kg. of oats, and invariably 3.5 kg. of hay and 1.2 kg. of straw like the control horses.

An examination of the total weight of the control group and the experimental group at the beginning and at the end of the experiment showed an increase of 40 kg. for the first group and of 59 kg. for the second. No difference was observed in the energy, temper, sweating, etc. of the horses in the two groups. No definite results could be obtained concerning the resistance to fatigue because the work done by the animals (2 hours' exercise per day) was modified throughout the experiment.

The results of the experiment led to the following conclusions :

1) The by-products of the decortication of rice are willingly accepted by horses, and it is best to give them mixed with oats or in the form of cake.

2) These by-products have no bad influence on the health of the horses.

3) About  $\frac{2}{3}$  by weight of the wheat ration may be substituted by the by-products without prejudice to the live weight, the energy and the temper of the horses.

4) Such a substitution is a real economic advantage (0.45 fr. per day per horse).

5) The by-products should be kept in a dry place in layers about 11 to 15 inches thick and turned over from time to time.

740 — Feeding Trials with Cattle at the Model Farm of Dikopshof, Germany. — RICHARDS, A., in *Landwirtschaftliche Jahrbücher*, Vol. 49, Parts 3-4. Berlin, 1916.

## I. — CALF RAISING.

Trials in order to determine whether the feeding stuff «cereal» (1) is capable of replacing (either wholly or in part) whole milk in raising calves.

About 30 calves received the feeding stuff in question over a period of 5 months. A number of difficulties were encountered in the course of the trials and the results were not very decisive. However, they have shown that «cereal» is better adapted to calves than to young pigs. The trials need to be repeated.

## II. — WINTER FEEDING OF HEIFERS.

Four trials conducted with animals from 1 ½ to 2 years, in order to determine whether it is profitable to dispense with hay in the winter feeding of heifers intended for breeding purposes; the writer describes three of these trials.

The 5 animals belonging to the first test were brought in from grazing on October 26, and received the following daily ration per head:

*From October 26 to November 7:* Oat straw 5 kg. — Ground-nut cake, 1 kg. — Mangolds 10 kg.

*From November 7 to December 9:* Same ration + 5 kg. of roots.

*From December 9 to April 10* (end of trial), same ration as at start.

The rations were always well accepted.

During the period of the trial, the live weight increase was 69 kg., or 416 gr. daily increase per head. The winter feeding cost in round figures 68 Marks (2) per head.

In the next trial, with 10 heifers, the beasts were brought into the stable on November 18. The ration was as follows: *Group I:* Oat straw, 5 kg. Ground-nut cake, 0.5 kg. — Mangolds 10 kg. In January and March the mangel ration was replaced by an equivalent amount of leaves and necks of sugar beets. The trial terminated on April 1.

The increase in live weight was 448 gr. daily per head for group I and 414 gr. for group II. The difference between the groups is consequently small, but a bigger ration of concentrates gives a corresponding increase in live weight. The winter feeding cost, according to whether 1 kg. or 0.5 kg. of cake was fed, 54 Marks and 42 Marks per head respectively.

The nutritive value of the ration administered being considerably below that given by KELLNER for young cattle, the writer concludes that heifers can be wintered all right on this ration provided they get sufficient to eat the following summer.

(1) See B. July 1917, No 652.

(2) For the purpose of this article 1 Mark may be regarded as equivalent to 1 shilling. (Ed.)



From April 1 till October 1, the heifers were at grass and development was perfectly normal.

The 19 beasts of the 3rd trial were divided into 4 groups. The daily ration per head was as follows.

*Groups I and II*: Oat straw, 4 to 5 kg. — Ground-nut cake (ground), 0.5 kg. — Dried mangold leaves 2.5 kg.

*Group III*: Oat straw, 5 kg. — ground-nut cake (ground), 0.25 kg. — Dried mangold leaves 2.5 kg.

*Group IV*: Oat straw, 5 kg. — Dried mangold leaves, 2.5 kg.

The trial, which was begun at the beginning of December for the two first groups and at the end of the same month for the two last, ended on March 24. At the beginning of the trial the heifers of groups I and II were 8 to 12 months old and those of groups III and IV 16 months.

In the course of the trial the live weight of the heifers of groups I and II showed a slight increase while that of the animals in groups III and IV showed no change. There is nothing surprising in this as the rations contained the minimum necessary for maintenance.

After the conclusion of the experiment the animals were put to grass and developed normally.

On the basis of these experiments the writer has evolved the following rations for feeding heifers through the winter without recourse to hay. Provided the animals get sufficient to eat when wintering is over their later development cannot be harmed by these rations.

#### *Winter Feeding of Heifers without Hay.*

Age of heifers at beginning of winter	Concentrates (if possible cakes rich in albuminoids or crushed pulses)	Straw (if possible good oat straw)	Green or dry fodder	
			Healthy roots rich in nutriment	Mangold leaves dried 1st quality
$\frac{1}{2}$ —1 year. . . . .	0.50 kg.	4 kg.	8 kg.	1.6 kg.
1— $1\frac{1}{2}$ " . . . . .	0.25 "	5 "	10 "	2 "
$1\frac{1}{2}$ —2 years . . . . .	— "	6 "	12 "	2.4 "

Each animal should receive as well a dose of salt and 20 gr. of assimilable lime.

### III. — FEEDING OF MILCH COWS.

Careful experiments lasting over a fortnight, the first week being regarded as a preliminary test and the second as the real experiment.

In addition to the basal ration and food under trial each animal received daily 30 gr. of kitchen salt and 30 gr. of assimilable lime.

*Dry yeast, sesame cake and maize gluten flour compared with ground nut cake*  
— In the first trial, from February 12 to May 2, with 12 cows in full milk, the

basal ration, contained, per 1000 kg of live weight, daily : Meadow hay, 10 kg. — Mangolds, 40 kg. — Slices of sugar beet, 4 kg. Its starch value was 8.5 kg. Four kilos of each trial food were administered. The starch value of the whole ration was 14.7 kg., the quantity of digestible albumen 2.813 to 3.059 kg.

In the 2nd. trial with 13 cows ( of which 4 were eliminated before the end of the trial), the basal ration contained, per 1000 kg. of live weight : Meadow hay, 10 kg. — Mangolds, 40 kg. — Slices of sugar beet, 4 kg. The trial food was administered at the rate of 4 kg. daily per 1000 kg. of live weight.

The two trials gave nearly the same result for the sesame cake and the maize-gluten flour but different results were obtained with yeasts. The yield of milk, indeed, was slightly diminished by the yeast, slightly increased by the maize-gluten flour and was unaffected by sesame cake. The fat content was unaffected by the yeast, but slightly decreased by the sesame cake and maize-gluten flour ; the former of these two last feeds gave the smallest fat content. The dry matter was influenced in the same way as the milk yield.

In conclusion, dry yeast, sesame cake and maize-gluten flour are not in normal times a very good feed for dairy cattle, but their use may still be recommended. More than 2 to 3 kg. daily per 1000 kg. of live weight should not be given however.

*Leaves of sugar beet dried and ensiled compared with hay and mangolds.* — The basal ration in the first two trials was composed of : 40 kg. of mangolds — 2 to 4 kg. of sugar beet slices — 3 to kg. of palm-nut cake - 1 to 2 kg. of wheat bran — 3.4 to 3.8 kg. of ground-nut cake. To this the writer added about 10 kg. of hay, 8 kg. of dried mangold leaves, 40 kg. of ensiled leaves. Starch value of the complete ration : 14 kg. daily per 1000 kg. of live weight. Number of cows : 11. Duration of trials. from Dec. 20 to April 22.

In two other trials, from January 11 to April 20, with 7 and 10 cows respectively, one or other of the following feeds was administered daily per 1000 kg. of live weight in addition to the basal ration : Mangolds, 40 and 60 kg. — Ensiled leaves of mangold, 40 and 60 kg. — Dried leaves of mangold, 8 and 12 kg. Starch value of the whole ration, 14 kg. Digestible albumen content, 2.483 to 2.724 kg.

According to the 4 trials, the dried leaves have given better results than the ensiled leaves as far as milk yield is concerned. With regard to the fat content, however, the ensiled leaves gave the bigger yield. The figures for the dry extract and the dry extract devoid of fat were modified in the same way as those relating to the milk yield. Generally speaking, the yield of fat is increased to a greater extent than the yield of milk. On those farms where great importance is attached to the fat content, hay and mangolds may well be replaced by dried and ensiled leaves of mangold, provided the remainder of the ration is properly constituted.

The writer recommends, however, not to give more than 50 kg. of



ensiled leaves and more than 10 kg. of dried leaves per 1000 kg. of live weight daily.

*Cacao and locust pods compared with barley.* — The 12 milch-cows received daily per 1000 kg. of live weight, a ration basal composed as follows: Meadow hay, 10 kg. — Mangolds, 40 kg. — Sugar beet slices, 3 kg. In addition they also received: about 4 kg. of barley, 4 kg. of cacao pods, 4 kg. of locust pods.

Starch-value of the ration: 14 kg.; digestible albumen: 2.5 to 2.7 kg. per ration. Duration of trial: Dec. 30 to Feb. 23.

The milk yield was greatly diminished by the cacao pods, but was practically unaffected by the locust pods. Taking the milk yield produced on barley as 100, the figure for the cacao pods is 85 and that for locusts 98.5. The fat content was greatly increased by the cacao pods and unaffected by the locusts.

The cacao pods are, consequently, not adapted to farms which attach particular importance to the quantity of milk while somewhat neglecting the fat content. The locust is a neutral feed capable of replacing other nutriments rich in carbohydrates but poor in albumen.

741 - I. Feeding Cottonseed Meal and Hulls to Dairy Cows. — II. Feeding Value of Cottonseed Meal vs. Cold Pressed Cottonseed Cake. — III. Feeding Value of Purchased Feeds vs. Pasture vs. Soiling Crops. — MOORE J. S., in *Mississippi Agricultural Experiment Station Bulletin* No. 174, pp. 1-16. Agricultural College, Mississippi, 1917.

I. The object of this investigation was to determine: first whether or not the continued use of cottonseed meal when fed in large quantities is injurious to dairy cows and, if injurious, the nature and character of the injury; second, whether or not the continued use of cottonseed hulls when fed in large quantities is injurious to dairy cows, and, if injurious, the nature and character of the injury.

Nine young cows were selected and divided into three lots of three cows each; later two heifers were added to each lot. The test continued over six years and some of the cows were in the test the entire time.

Lot 1 received a heavy ration of cottonseed meal with little other grain feed and no cottonseed hulls for roughage.

Lot 2 received a heavy ration of cottonseed hulls with no cottonseed meal.

Lot 3 received no cottonseed products.

A record of each cow in the test, from the time she entered until its close, was kept, howing the number of times each cow was bred, the number of calves dropped, the dates calves were dropped and the length of time between births; the total feed given each cow during the test, the average feed per day per cow, together with the production of milk and butter fat and the abnormal conditions, if any, occurring in the case of each animal.

Results indicate that there were 14 cases of garget in cows of Lot 1, one case in Lot 2, and two slight cases in Lot 3. In Lot 1 one cow lost two quarters of her udder and two cows lost one quarter each. In Lot 2 one cow lost one quarter. In Lot 1 three cows retained afterbirth, there



was one case of abortion, one calf came dead and another one was very weak at birth. Two cows in Lot 1 were in poor physical condition for a time. In Lot 1, and to a smaller extent in Lot 2 there was some difficulty in getting the cows "safe with calf". In Lot 2 one cow had milk fever and one died after being in test for eight months.

The feeding of five pounds of cottonseed meal for any length of time is therefore to be considered injurious to the dairy cow, causing inflammation of the udder, difficult breeding, and probably having a tendency to cause retention of afterbirth.

Feeding cottonseed hulls at a rate of 15 lbs. per day appears to cause difficult breeding, though not so the same extent as the feeding of cottonseed meal.

Where plenty of silage is available for the winter months and good pastures are provided for spring, summer, and fall so that the cows will not require much grain feeding during a large part of the year, as much as four pounds of cottonseed meal has not seemed to injure the cow in any way.

II. Three lots of seven cows each were used in the test to determine the feeding value of cottonseed meal vs. cold pressed cottonseed cake. Each lot was given the same feed for a period of three weeks, consisting of an average ration of 4 pounds of cottonseed meal, 7 pounds of Johnson grass hay, and 42 pounds of corn silage. The cows were then divided into three lots and fed for a period of nine weeks on the following average ration for the cows in each lot.

No. of Cows		Daily ration		Wheat Bran lbs.	Cottonseed hulls lbs.	Johnson grass hay lbs.
		Cottonseed meal lbs.	Cold pressed Cottonseed Cake lbs.			
Lot I	7	5	—	3	2.5	13 3/7
Lot II	7	—	7.5	3	—	13 3/7
Lot III	7	5	—	3	—	13 3/7

At the close of the test period, the cows were again put on the same average ration for each lot and fed for a period of four weeks. The ration consisted of good pasture and 4 pounds of cold pressed cottonseed cake.

Considering the average weekly milk production of the cows in each lot for the three periods, and the weight of the cows at the beginning and at the close of the test period, the results from these three rations are very nearly the same. Those from lot 2 where cold pressed cake was used, were slightly better than from the other two.

*Relative value of grain feeds.* — From these tests, and from previous tests of the Mississippi Experiment Station, published in former bulletins now out of print, the following conclusions were drawn:

- 1) One pound of cottonseed meal equals 1.72 lbs. of cottonseed.
- 2) One pound of cottonseed meal equals 2 lbs. of corn and cob meal, or corn meal.
- 3) One pound of cottonseed meal equals 1.5 lbs. of wheat bran.

III. Fifteen cows were selected for this experiment and divided into three lots of five cows each. They were fed for three periods of six weeks each. During the first period of six weeks, cows in Lot 1 received purchased feeds, the cheapest that could be bought—quality considered; cows in ed Lot 2 were on good pasture of oats and hairy vetch; cows in Lot 3 were alfalfa as a soiling crop. During the second period of six weeks, Lot 1 received purchased feeds; Lot 2 were put on pasture of bermuda, white clover, smooth vetch and mixed grasses; Lot 3 were fed alfalfa and Johnson grass as soiling crops.

The cows on pasture and those getting soiling crops received about a half ration of grain feed in addition.

The market value of all dry feeds was used in estimating the cost of the feed eaten by each lot. Soiling crops were valued at the cost of production, including rent on land, cost of seed, planting, etc. Estimated values are as follows:

Cottonseed meal per ton . . . . .	\$ 28.00	Johnson grass hay . . . . .	\$ 12.00
Wheat bran per ton . . . . .	28.00	Alfalfa hay per ton . . . . .	15.00
Green alfalfa per ton . . . . .	1.50	Cottonseed hulls per ton . . . . .	8.00
Green Johnson grass per ton . . . . .	1.50	Pasture per cow per month . . . . .	0.75

A comparison of the cost of feed for the several lots shows a marked difference. The cost of feeding the cows receiving purchased feeds was 19.52 cents per cow per day. The cost of feed for cows on good pasture was 8.0 cents per cow per day. The cost of feed for the lot receiving soiling crops was 9.0 cents per cow per day.

At the close of the third period the cows had been in milk since calving about seven and a half months and while above the average cow in the State of Mississippi in yield of milk and butter, they had about reached the point where with only purchased feeds the value of the milk would have little more than paid for the feed eaten. There was no great difference in the cost of feeding soiling crops and providing good pasture, but where it was necessary to purchase all the feed used the cost was more than doubled.

The value of the above facts will be appreciated when it is realized that either good pasture or soiling crops can be provided at least eight months in the year. Usually by a combination of the two methods the time can be extended to nine, or even ten months.

742 - **Skim Milk and Milk Substitutes for Calf Feeding.** — HUNZIKER, O. F. and CALDWELL R. E., in *Purdue University Agricultural Experiment Station Bulletin* No. 193, Vol. XIX, pp. 1-104. Lafayette, Indiana, September 1916.

The purpose of the experiment recorded in this bulletin is to furnish the dairyman with practical and reliable information as to the proper preparation and use of rations for calf feeding when the market value of

whole milk and its products is too great to permit of its economical use for this purpose.

Three rations were used in this experiment as indicated below.

Lot I. Ration 1 (Skim milk). Consisting of whole milk, skim milk, ground corn and oats as a dry mash, alfalfa hay and corn silage.

Lot II. Ration 2 (Home mixed calf meal). Consisting of whole milk, home mixed calf meal (containing hominy feed, linseed meal, red dog flour and dried blood, equal parts by weight), ground corn and oats as a dry mash, alfalfa hay and corn silage.

Lot III. Ration 3. (Blatchford's Calf Meal). Consisting of whole milk, Blatchford's Calf Meal, ground corn and oats as a dry mash, alfalfa hay and corn silage.

The above rations were fed for a period of 182 days to three lots of ten calves each. Most of the calves used in this experiment were pure-bred animals from cows belonging to the Experiment Station dairy herd.

The record of the performance of each individual calf was kept separately, both in regard to feeds consumed and the variation in live weight. A daily record was made of the feeds fed and the body weight was determined at the end of each seven days. At the conclusion of each thirty days the calves were photographed under standard conditions and in a way that would show the physical condition of the calf as well as the variation in size. These photographs represented six thirty-day periods during the first six months of the calf's life and are presented together with a tabulated average daily summary of the feeds consumed, composition of ration, cost of ration, and variations in live weight.

The chemical composition of all feeds and the prices of feeds are given in the following tables I and II.

TABLE I. — *Chemical Composition of all Feeds used in the Experiment.*

Name of feed —	Dry matter %	Crude protein %	Carbo- hydrates %	Fat %	Ash %
Whole milk . . . . .	11.58	2.85	5.08	3.00	0.65
Skim milk . . . . .	10.05	3.96	5.30	0.04	0.75
Blatchford's Calf Meal. . .	88.68	28.10	50.06	5.47	5.05
Home mixed Calf meal. . .	89.59	36.45	45.70	4.59	2.85
Alfalfa hay. . . . .	91.79	14.21	69.62	1.48	6.48
Oats . . . . .	87.67	11.76	67.73	4.18	4.00
Corn. . . . .	82.69	8.80	68.82	3.82	1.25
Corn silage. . . . .	39.19	3.88	32.39	1.13	1.79
Hominy . . . . .	88.68	10.67	69.98	5.55	2.48
Linseed meal. . . . .	91.18	32.73	43.32	10.30	4.83
Red dog flour . . . . .	87.80	15.15	69.49	2.01	1.15
Dried blood . . . . .	90.70	87.26	—	0.49	2.95



TABLE II. — *Prices of Feeds used in the Experiment.*

Name of feed	Price of feed
Whole milk. . . . .	\$ 1.50 per 100 pounds
Skim milk. . . . .	0.25 per 100 pounds
Corn. . . . .	0.60 per bushel
Oats. . . . .	0.40 per bushel
Alfalfa hay. . . . .	15.00 per ton
Corn silage. . . . .	4.00 per ton
Home mixed calf meal. . . . .	40.00 per ton
Blatchford's Calf Meal. . . . .	70.00 per ton

The comparative efficiency of the various rations used is presented in the following tables.

The average live weight, gain and cost of gain of the three lots is given in Table III.

TABLE III. — *Showing Live Weight, Gain and Cost of Gain in Lots I, II and III.*

	Birth weight	Final weight	Total gain	Daily gain	Cost per pound gain	Average daily cost	Total cost
	lbs.	lbs.	lbs.	lbs.	cents	cents	\$
Lot I	61.7	282.8	221.1	1.21	5.7	6.9	12.63
Lot II	69.6	244.1	174.5	0.95	7.4	7.1	12.93
Lot III	68.2	200.2	133.4	0.73	13.18	9.58	17.44

The average daily ration consumed is given in Table IV.

TABLE IV. — *Showing average daily ration consumed by Lots I, II and III.*

	Whole milk	Skim milk	Water	Home mixed calf meal	Blatchford's calf meal	Dry mash	Alfalfa hay	Corn silage
	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.
Lot I	0.72	11.11	—	—	—	0.98	2.50	0.33
Lot II	1.17	—	8.64	1.33	—	0.84	2.18	0.22
Lot III	2.46	—	7.67	—	1.07	0.77	1.61	0.21

The total amount of food nutrients consumed is given in table V.

TABLE V. — *Showing total amount of Food Nutrients consumed.*

	Dry matter	Crude protein	Carbohydrates	Fat	Ash
	lbs.	lbs.	lbs.	lbs.	lbs.
Lot I	812.86	169.3	572.88	19.3	51.31
Lot II	755.69	169.0	517.66	30.1	38.89
Lot III	628.39	125.14	432.6	34.44	36.14

The average daily rations and their nutritive ratio is given in Table VI.

TABLE VI. — *Showing Average Daily Rations and Their Nutritive Ratio.*

	Dry matter	Crude protein	Carbohydrates	Fat	Nutritive ratio	Live weight
	lbs.	lbs.	lbs.	lbs.	—	lbs.
Lot I	4.46	0.93	3.14	0.106	1 : 3.6	282.8
Lot II	4.15	0.93	2.84	0.165	1 : 3.4	244.1
Lot III	3.45	0.687	2.37	0.189	1 : 4.0	200.2

The relationship between height and weight is a true index in regard to the physical condition of the calves throughout the experiment. For each inch in height, Lot I averaged 4.95 pounds or 6.87 % more than Lot II and 20.40 per cent. more than Lot III. The relation between height and live weight is given in Table VII.

TABLE VII. — *Showing Relation Between Height and Live Weight.*

	First month	Second month	Third month	Fourth month	Fifth month	Sixth month	Average
	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.
Lot I	2.99	3.83	4.43	5.44	6.16	6.88	4.95
Lot II	3.11	3.59	4.06	4.95	5.64	6.32	4.61
Lot III	2.69	2.98	3.49	4.29	4.85	5.32	3.94

From the results presented in the preceding tables it appears that where skim milk is available as a feed for young calves and its market value is not above thirty cents per hundred pounds, milk substitutes for dairy calves are of comparatively limited value. In sections where the chief product sold from the farm is whole milk, the use of a home-mixed calf meal is advisable although the calf so produced will not be as well developed at six months of age as if fed with milk during its early growing period.

The prices charged by concerns manufacturing calf meals are usually very much above the actual cost of producing them. All things being equal so far as the efficiency of the ration is concerned, the use of a ready-prepared calf meal is largely prohibitive on account of the high retail prices of such feeds.

In order for a ration to be considered an unqualified success for dairy calves, it should produce, at least, one pound of gain per day as an average for the first six months of the life of the calf. An average daily gain of 1.5 pounds is not uncommon, although slightly above that which the average dairyman may expect.

The amount of food nutrients required per day by growing calves is, approximately, 0.33 lb. of protein, 1 lb. of carbohydrates and 0.05 lb. of fat, these figures being based upon the total amount rather than the amount of digestible nutrients consumed.

The rate of growth in height of dairy calves is rather uniform during the first six months of their lives. The average monthly growth for an average sized calf should be from 1.5 to 2 inches, although certain individuals may much exceed these figures.

A calf at thirty days of age should weigh, approximately, 3 pounds for each inch in height. This figure gradually increases until at six months of age the average calf should weigh, approximately, 6.5 pounds for each inch in height.

743 — **The Production of Baby Beef.** — RAY, S. H., in *U. S. Department of Agriculture, Farmer's Bulletin No. 811*, pp. 1-24. Washington, D. C., April 1917.

During recent years the United States live-stock markets have undergone a great change which has reacted strongly on the breeding industry. This change is expressed by the ever-increasing demand for high-grade,

well-fattened calves weighing from 900 to 1200 lbs. This demand could only be satisfied by animals of from 14 to 20 months belonging to the early-maturing beef breeds, Hereford, Aberdeen-Angus or Shorthorn. As this class of animal differs markedly from other beef classes it is called "baby beef".

The production of this type of cattle demands more skill than that of older slaughter animals, since the latter is chiefly fed on the cheaper roughages of the farm. Farmers are also attracted to this industry by the increasing scarcity of feeder cattle, a scarcity often connected with the progressive increase in land-values, the cost of labour, taxes, etc., which, in many districts, make it difficult to realise profits on older cattle. Thus butcher's cattle of from 3 to 5 years bred on ranches were replaced, first by adult animals fattened on mixed farms, then by baby beef raised on intensive breeding farms. Baby beef is obtained by using the maximum productive capacity of the earliest maturing breeds, and by intensive feeding.

This change is due to many causes. Foremost of all is the fact that young cattle make better gains than older cattle on the same quantity of foodstuff. Yearlings can make 25 to 40 % more gain than mature cattle on the same amount of food. As the period of production is shortened, it is possible, with the same amount of feed and pasture, to increase the number of breeding cows and the number of calves produced every 18 months. Heifers, fattened on the same system, may be sold when 18 months old as they will then weigh from 900 to 950 lbs. and will have cost the same amount as the steers. When over 2 years they are already subject to the depreciation of all butcher's animals. Moreover, baby beef, when fattened for market under 2 years of age, allows the farmer to choose the moment when good prices may be realised, for, between the age of 14 months and 2 years the animal is always in good condition for the market. The period of fattening may thus be lengthened when prices are low and shortened when they are high. This greatly helps to keep the market steady. The consumer prefers the size and quality of the cuts from a well-bred, highly finished yearling, and markets, which are more stable for this class than any other class of cattle, are paying a premium for this product. Prime baby beef usually commands a price equal to that of the highest grade of mature fat cattle.

All breeding farms are not suited to the production of baby beef, in fact there are certain conditions under which it is inadvisable. A good breed of early maturing cattle, good pasture and a plentiful supply of concentrated foodstuffs are essential to success.

As a rule pure-bred cows are not necessary, but they should have two or three crosses with a pure beef-strain to avoid a preponderance of dairy blood which prevents the successful rearing of baby beef. The most satisfactory results are obtained with pure-bred selected Aberdeen-Angus, Shorthorns and Herefords, and the herd bulls, in all cases, should be chosen from these breeds. The most recent experiments show that it is most advantageous to breed and fatten the calves on the same farm.

When breeding baby beef it is important to give them concentrated



foodstuffs with a grain basis. Except in cases in which the cows produce a certain amount of milk during the weaning period it is best to give these foods to the calves as early as possible, that is to say, when they are from 4 to 6 weeks old. Where pasture is available, autumn-born calves are turned out to graze in spring; this enables the amount of roughage fed to be reduced to a minimum, while as much concentrated foodstuff as possible is still given. In some cases very good pasture prevents the animal from consuming the desired amount of grain, and causes a set-back in the increase of weight. During the last fattening period pasture should not be used. Where winter pastures are available they will greatly decrease the cost of both growing and fattening the calves.

The baby beef industry also helps to develop the hog breeding industry, as the residues of the concentrated foodstuffs used may thus be best utilised. Shoats from 70 to 100 lbs. are used, and consume the undigested cereals given to the cattle. As maize is the chief concentrated foodstuff used during fattening, the breeding of hogs on the residues of the fattening adds greatly to the profits. From 1 to 2 lbs. of pork may be obtained for each bushel of maize fed to the calves.

Tables are given of the progressive quantities of concentrated foodstuffs which should be given to the calves month by month, both for those to be finished in 15 months and for those to be finished in 18 months, autumn and spring born calves being considered separately.

744 - **The Shorthorn in Ireland.** — *Live Stock Journal*, Vol. LXXXVI, No. 2257, p. 3. London, July 6, 1917.

In a recent publication, the Irish Shorthorn Breeders' Association describes the development in Ireland of the dual purpose Shorthorn breed. In the Department of Agriculture's Register of Dairy Cattle are entered 478 cows giving from 5 000 to 6 000 lbs. of milk, 1 601 producing from 6 000 to 8 000 lbs., 488 producing from 8 000 to 10 000 lbs., and 106 yielding more than 10 000 lbs.

The cows yielding less than 6 000 lbs. were entered in the control register before 1912, the year in which the standard was raised from 5 000 to 6 000 lbs. The importance of this selection of the Shorthorn breed in Ireland in order to produce meat as well as milk is obvious when it is considered that, before the war, Ireland exported annually to England 832 000 head of slaughter cattle, representing a value of £ 11 876 000, and 752 000 cwt. of butter, representing a value of £ 3 900 000. Moreover, the predominance of small and medium sized farms in Ireland gives a greater importance to the breeding of dual purpose animals which may meet the requirements both of the meat market and the dairy industry; this applies particularly to pure-bred Shorthorns.

PIGS

745 - **Experiments in the Disposal of Irrigated Crops through the Use of Hogs.** — HOLDEN, JAMES A., in *U. S. Dept. of Agriculture, Bulletin* No. 48, 25 pp. Washington, D. C., Feb. 26, 1917.

The farmer who makes a success on high-priced irrigated land must not only grow large crops, but he must market these crops in the most ad-

vantageous way. Most crops grown in localities far removed from the large consuming centres should be marketed in condensed form, so as to reduce the cost of transportation. For example, a hundred pounds of butter can be shipped to market much more cheaply than the hay and grain required to produce this butter. The farmer should take advantage of this fact in organizing his operations. In addition to this saving, the manure resulting from the feeding of the crops makes it possible to produce larger crops in subsequent years.

Because of the relatively small capital and short time required to get a start in the swine industry and because of the high efficiency of hogs in utilizing certain field crops, swine production is a specially promising industry for irrigation farmers. In order to secure information regarding methods of utilizing hogs in the disposal of certain field crops produced on irrigated lands, experiments were conducted at the Scottsbluff Experiment Farm on the North Platte Reclamation Project in 1912, 1913, 1914 and 1915.

In three years' experiments, with eight lots of hogs, and during which alfalfa pasture was supplemented with a 2 per cent ration of corn, an average gain of 3.181 pounds per season was made from an acre of alfalfa pasture and 7.844 pounds of corn. It required an average of 2.47 pounds of corn in addition to alfalfa pasture to produce 1 pound of pork. If the gains are valued at 7 cents a pound and corn at 60 cents a bushel, or \$ 1.07 a hundred-weight, the average annual return was \$ 138.75 per acre of alfalfa pasture. If the corn fed is valued at 60 cents a bushel and the alfalfa pasture at \$ 15 an acre the average cost of 100 pounds of gain was \$ 3.11. If the average yield of the alfalfa plats in the same field is assumed to represent the yield of the pastured plats the hogs paid an equivalent of \$ 25.13 per ton of hay.

In two years experiments with alfalfa pasture, with and without supplemental feed, an average annual return of \$ 45.08 per acre was secured where no supplement was used, as compared with \$ 70.20 where a 1 per cent. ration of corn was used — \$ 128.49 from a 2 per cent. ration of corn — \$ 121.96 from a 2 per cent. ration of barley, and \$ 168.25 from a 3 per cent. ration of corn. The rate of gain and the carrying capacity of the pasture increased with the quantity of grain fed. Ground barley appeared to be as good, pound for pound, as shelled corn as a feed for hogs on alfalfa pasture.

Sows and pigs on alfalfa pasture, with a 2 per cent. ration of grain, made an average gain of 1.574 pounds per acre of alfalfa pasture from May 1 to July 1, or a net return of \$ 66.84 per acre. When corn was used the return varied from \$ 54.11 to \$ 69.97 per acre, and when barley was used the return was \$ 77.76 per acre.

In three years' experiments, hogging corn without supplementary feed produced an average of 896 pounds of gain, worth \$ 65.72 per acre, or \$ 1.50 per hundredweight of the estimated yield of corn.

In two years' experiments, hogging corn without supplementary feed produced an average of 744 pounds of gain, worth \$ 52.08 per acre, as com-



pared with 930 pounds of gain, worth \$ 65.10, where the hogs had access to alfalfa pasture, and 1,029 pounds of gain, worth \$ 72.03, where the hogs were fed tankage in addition to the corn. Where no supplementary feed was used the hogs paid \$ 1.34 per hundredweight for the estimated yield of corn, as compared with \$ 1.55 per hundredweight where the hogs had access to alfalfa pasture and \$ 1.50 per hundredweight where tankage was used. The use of either alfalfa or tankage resulted in more rapid and cheaper gains than were secured where no supplementary feed was used.

**746 - Profitable Pork Production in the United States.** — WALTER, H. B., in *Missouri State Board of Agriculture, Monthly Bulletin*, Vol. XIV, No. 8, pp. 21-25, Columbia, Mo., 1916.

The pork production branch of the live stock industry of the United States supplies over sixty per cent. of the meat diet of the country.

One reason the hog is such a great factor in meat supply is because of his prolificacy. The increase from cattle is estimated to be from 80 to 90 per cent. in one year; of sheep it is from 100 to 150 per cent.; while in hogs it is from 1000 to 1800 per cent. yearly. The hogs can populate the farms with meat producing animals in a short time and *overcome any meat shortage that may exist.*

The hog is a very efficient animal because he can produce a pound of meat from less than any other animal. It requires about thirteen pounds of dry matter to produce one pound of gain in cattle, about eight to nine pounds in sheep and only four to five pounds in hogs.

The hog dresses a higher per cent. of edible meat. Cattle dress from 60 to 65 per cent., sheep 55 to 60 per cent., while hogs dress from 75 to 80 per cent.

There is more energy in a pound of pork than in either a pound of beef or mutton. Comparing fresh ham with fresh hindquarter of beef and mutton, a pound of the ham has 60 % greater energy value than a pound of mutton and 45 % greater energy value than a pound of beef.

The essentials in producing hogs at a profit in the United States are the following: the person engaging in the business must have a liking and capability for the business; have a good location; select well bred animals, have a reasonable amount of equipment; feed a balanced ration, *including pasture*; keep the herd free from disease; find or make a good market for the product and last, but not least, keep an account with the herd, so that it may be known whether the hogs are making a profit or loss, and how much.

#### POULTRY

**747 - Breeding for Egg Production-A Study of Annual and Total Production.** — BALL E. D., BYRON ALDER and EGBERT, A. D., in *Utah Agricultural College Experiment Station Bulletin* No. 148, 60 pp., 22 tables, Logan, Utah, December, 1916.

Work on White Leghorns at the Utah Experiment Station aims at establishing the factors upon which to base a rational system of selection for increased egg production. The present paper gives the two-year records of the Station flocks from October 1913 and discusses annual and total production.



The following conclusions are drawn from the records:

The production of unselected White Leghorns varies in different years as influenced by the environment, but from all available records averages about 130 for the first year, 120 for the second and less than 110 for the third, drops to about 85 in the fourth and falls about 10 eggs a year after this up to the eighth year. Selected flocks have averaged about 160 in America and 190 in Australia. The American record corresponds closely to the average upper one-half of the unselected flocks and indicates that the selection has been able to eliminate the lower half.

The first year production of a flock of White Leghorns is no indication of their total production, if the first year is high the second will be low, if the first is low the second will be high, but the total production in three years will in all cases be about the same.

If the first year record of a flock is high, selection of the high layers will materially improve the later production of the flock. If the first record is low there will be little value in selection as even the lowest producer will make a second year record above the general average. The three year average is in all cases a much more reliable indication of productivity.

The average life of a White Leghorn appears to be about 6 years. The average total production is above 500 eggs and the maximum possible production above 1000.

The White Leghorn is the most important egg producing breed at the present time; over one half of all contest entries are Leghorns. The average production has been decidedly above the average of the general purpose breeds. Three-fourths of all contest entries have been white.

A Bibliography is appended which cites 40 publications.

748 - **Grafting of the Ovary in Rouen and Pekin Ducks.** — KALTENBACH, R., in *Zeitschrift für induktive Abstammungs- und Vererbungslehre*, Vol. 27, Part 3, pp. 251-253. Leipzig, March 1917.

In researching on the question of the heredity of acquired characters it is necessary to know whether the first appearance of the same character in the mother and her descendants is due: a) to the fact that the body of the mother and the germ cells have been influenced in like manner by external factors, or b) to the fact that external factors first modified the maternal organism, this modification afterwards being transmitted by the body to the germ cells.

In order to confirm the possibility of the second phenomenon occurring, GÜTHRIE in 1908, made experiments on transplanting the ovary in black and white fowls, the results of which proved, according to GÜTHRIE, the transmission of new somatic characters to the germ cells. He had grafted the ovary of a black fowl upon a white fowl whose ovary had been removed and after crossing this latter with a black cock obtained black and white offspring. DAVENPORT explained this result by saying that the ovary of the white fowl had only been partially eliminated, the remainder of the ovary was regenerated and the new ovary belonging to the black race reabsorbed.

The present writer has repeated GUTHRIE's experiments on pure races of ducks.

Firts of all he established, by means of preliminary experiments, that owing to the interlacing of the ovary with the vena cava it is quite impossible to detach the former completely. Detachment of a portion of the ovary is naturally not difficult. He was therefore obliged to destroy the ovary (about the size of a bean) in another way; this was accomplished by the use of 40 % formalin. On killing the animal after treatment it was seen that the ovary was completely hardened. In order to make quite sure that the ovary left no remainder capable of regeneration, a couple of Pekin ducks were kept for a whole year after cutting; after the first moult both had typical male plumage; dissection showed that the ovary had disappeared.

Complete removal thus being certain, the writer exchanged the ovaries of Rouen and Pekin ducks, 8 weeks old. After a year it was seen that the grafted ovaries had disappeared and on the completion of the spring moult there appeared the characteristic plumage of the male bird.

The writer's results thus confirm DAVENPORT'S conclusion noted above.

## BEE-KEEPING

749 - New Hive with Store Chamber: the "Sans Souci".—FOURNIER, M., in *L'Apiculteur*, 61 st. Year., Nos. 3 and 4, pp. 50-54. Paris, March April 1917.

The writer gives a description of his new hive, the "Sans Souci", and shows the great advantages resulting from its use. It is neither on the hori-

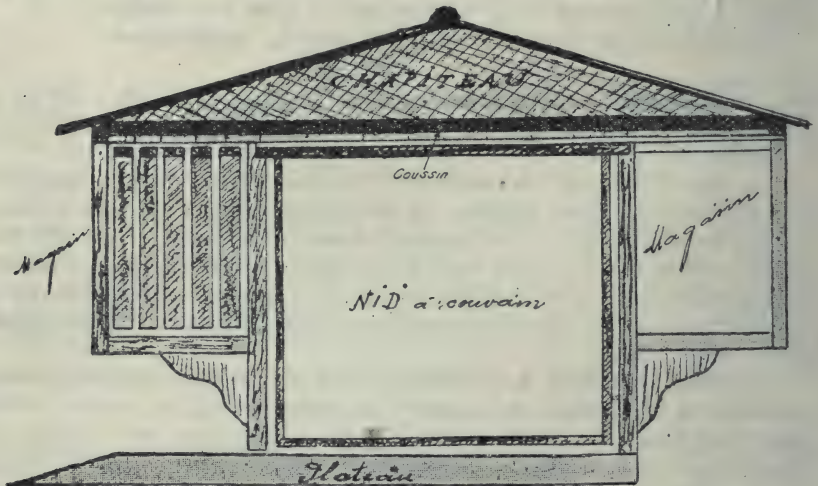


Fig. 1. — Vertical section of the « Sans Souci » hive.

zontal nor vertical system but owing to the suppression of the additional racksit resembles more the horizontal hives than any other.

As shown in fig. 1, it consists of a hive body, intended for brood, to the front and back of which are suspended two box-compartments serving as store-chambers, the front one overhangs the entry and thus avoids the use of a hood. These compartments are arranged to receive 5 super frames. They communicate with the brood chamber by means of a horizontal slit, not more than 4 mm. long, which only allows the workers to enter and is closed by means of a key of strong flattened wire which can be worked from the outside (fig. 2). As only the worker can enter the store chambers, the frames will always be free of brood.

Owing to these chambers forming a double wall or air cushion, the temperature of the brood chamber is constant and the hive can be built of 15 mm. match-boarding.

The system of communication between the brood and store chambers allows one to examine the frames at any time without having to smoke the

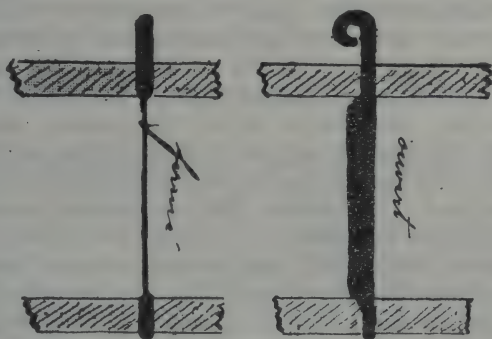


Fig. — Key for opening or closing passage to store chamber.

hive: a little smoke in the store chambers is sufficient to chase off the workers.

If artificial feeding is required, the necessary frames or syrup can be placed in the store without disturbing the whole hive. It is useless to store the frames in the laboratory where they are only in the way; after extraction of the honey they can very well remain in the store chambers till the following crop where they, are protected from parasites.

In usual conditions the hives require visiting 5 times in the course of the year. With the "Sans Souci" the process is as follows:

- 1) In spring the state of the colony can be ascertained by looking through the piece of glass along the edge of the frames.
- 2) At the time of the honey flow in May or June, when an additional rack is added to the usual type of hive, the only thing to be done with the hive under consideration is to give the key a half-turn in order to let the bees have access to the store-chamber.
- 3) At the end of the season when after looking through the observation panes behind each store chamber the frames are seen to be full, the bees



in these latter are chased off with a little smoke, the passage closed and the frames removed.

4) The empty frames are replaced in the store-chamber without disturbing the bees, as until the passage is opened they are unable to enter.

5) During the winter the passage communicating with the store-chamber must be kept closed as it might prove fatal to the bees if they were to remain within.

Instead of 5 visits, one visit only will suffice, *viz.* in spring in order to make sure of the condition of the colony and to clean the baseboard.

## SERICULTURE

750 - **The Pebrine Disease of Silkworms in India.** — HUTCHINSON, C. M., in *Agricultural Research Institute, Pusa, Bulletin* No. 75, pp. 5, 2 Pl. Calcutta, 1917.

In the course of his enquiry into the causes of the decadence of the Indian Silk Industry, Prof. LEFROY came to the conclusion that the chief cause is the great prevalence of the "Pebrine" disease of silkworms. PASTEUR, who discovered the cause of the disease to be a microscopic organism, also devised a method of checking and diminishing the disease. This method has been in successful use for some 40 years in France and Italy, and as Prof. LEFROY'S inquiries showed that the Pasteur method for eliminating pebrine has been a failure, the present writer commenced an enquiry into the subject with the view of finding out why the PASTEUR method had failed in Bengal and if possible to discover a suitable modification or alternative. The present Bulletin gives an *interim* report on the writer's investigations to date.

The essence of the Pasteur method consists in the fact that the pebrine bodies — the spore form of the parasite — as seen when the body of the moth is crushed in a little water, a drop of the resultant fluid being examined under a magnification of 500-600 diameters, are easily recognizable. If pebrine bodies are seen, the eggs of this moth are destroyed. *The success of this method for eliminating the hereditary infection depends on the assumption that if there is sufficient disease present in a moth to affect the progeny, its presence will be detectable by the above method.*

As far as India is concerned the method requires serious modification. The essential difference between European and Indian conditions is that in Europe there is only *one* generation a year, while in India usually *seven* or *eight* generations are produced. Again, in India the eggs hatch out within some 8 days after laying, while in Europe the eggs are laid in summer and do not hatch till the following spring. Therefore in India the moth must be examined within a week after egg laying. It was further found that a large percentage of diseased moths were passed as disease-free under these conditions.

The writer found that the above assumption on which the Pasteur method is based does not hold good for India. In India the fresh body has to be examined (in Europe the dried body) so that the liquid for the test is mostly obtained from the colon, an organ found to little invaded by the parasite in comparison with the ovaries and other parts of the body.

By examination of a large number of pebrinised moths, it was found

that the pebrine "corpuscles" first seem to appear or are to be found if present at all, in the gut or chyle stomach. The gut is readily accessible by separating the lower portion of the abdomen, leaving the gut canal exposed. A portion of the gut removed with a needle and rubbed in water on a slide will show the presence of pebrine bodies if they occur in sufficient number to be detected by such a rough microscopic examination.

The reason why pebrine is more likely to be detected by examination of the tissues of the gut is that the moth is infected (excepting hereditary infection) through the food and alimentary canal; the parasite enters and spreads from the walls of the gut. It then follows that as the parasite grows by feeding on the tissues of its host, the food supply afforded by the latter must fail at the point first invaded. As failure of nutriment causes the parasite to pass into the spore condition, the condition most easily recognizable under the microscope, it is obvious why the gut tissues present the most likely point for discovering the presence of the parasite. Again, the gut elements in the moth are known to be reconstructed during the pupal stage from the same as those in the larva from which they are derived.

The writer advocates the use of the above method in India to obtain disease free eggs for rearing those races that produce several generations a year.

- 751 - On the Biology of the Shad (*Alosa finta* Cuv.) of the Algerian Coast. — BOUNHIOL J. P., in *Comptes rendus des Séances de la Société de Biologie*, Vol. LXXX, No. 10, pp. 480-483. Paris, May 19, 1917.

FISH CULTURE

Following the example of ROULE (1), the writer has been lately researching as to whether the factor determining the migration of the shad was not of the nature of a respiratory tropism, the fish seeking the waters of highest oxygen content.

By dissolving different quantities of oxygen in sea water, fresh and brackish water at different times of the year, the writer has obtained results of a definitely conclusive character and completely confirming those obtained by M. ROULE.

The differences in degree of oxygenation existing between sea water and fresh water in spring favour the former, and in winter the latter; this explains why the spawning migration of "potomatoques" (species living in the sea which periodically spawn in freshwater) takes place in spring, whilst that of "talassotoques" (species living in fresh water and spawning in the sea) takes place in autumn or in winter.

- 752 - Fish-breeding in Switzerland during 1916 (2). — *Bulletin Suisse de Pêche et Pisciculture*, Year XVIII, No. 5, pp. 75-78. Neuchatel, May 1917.

The number of breeding stations during 1915-1916 was 224. From 157 971 000 eggs the number of larvae hatched out was 127 033 000. Of these, 126 222 400 were set free in Swiss public waters under official control. These included 58 393 of a single summer or a year old. The numbers of larvae of different species bred in hatcheries was as follows :

(1) See B. 1916, No. 453 and B. Jan. 1917, No. 70.

(Ed.).

(2) » B. 1915, No. 893.



A. — *Native species.*

Salmon . . . . .	1 722 000
Salmon trout, hybrids. . . . .	97 000
Lake trout. . . . .	2 503 000
River and stream trout. . . . .	9 986 000
<i>Salmo alpinus</i> ("ombles-chevaliers") . . . . .	4 303 000
River charr . . . . .	2 577 000
Coregonus . . . . .	92 328 000
Pike . . . . .	13 287 000

B. — *Foreign species.*

Rainbow trout . . . . .	215 000
American river charr . . . . .	15 000

Total . . . . .	127 033 000
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The confederation has paid to the Cantons for distribution among the fish breeders concerned a subsidy of 34 700 francs for the incubation of eggs and releasing the larvae in public waters. The Canton of Valais is not included in this figure, as breeders there have not applied for a subsidy. No breeding has been carried out during the season in the canton of Appenzell, Rhodes Intérieures.

The Swiss Society for Fishing and Fish-breeding has received a Government subsidy of 3 000 francs. As in the case of other river states, the Swiss Federation has granted a subsidy of 300 francs to the International Union of Fishermen on Lake Constance to cover the cost of stocking this lake with fry in 1916. During this same year Swiss fishermen have taken from this lake, including the Lower one, 135 494 kg. of fish worth 296 833 francs.

The number of bailiffs in the service of the Cantons during the 1915 season was 164 with 7 temporary assistants. The salaries, travelling expenses, etc., of these guards amounted to 109 098.70 francs. 50 % of this sum was borne by the Confederation. The Cantons have spent a further sum of 604 francs on destroying animals injurious to fish.

Fish ladders have been built in the neighbourhood of the power stations at Eglisau and elsewhere along the Rhine and also near the factories at Aarau.

The Swiss Central authority has obtained data from the various cantonal governments relating to fish ladders in the different waters. These data are to serve as a basis for a careful study of the whole question of fish ladders.

## FARM ENGINEERING.

753 — **Mechanical Cultivation in France.** — DANTHIN, CH., in *Le Génie Civil*, Vol. LXX, Year 37. Nos. 15 and 16, pp. 237-240 and 256-260. Paris, April 14 and 21, 1917.

The writer emphasises the importance of mechanical cultivation and gives an account of the legislative measures taken in France in order to encourage its development. He then examines the conditions which govern the use of mechanical power and describes the principal types of tractors tested during the last 2 years. He also gives an account of the economic results obtained in recent trials.



TRACTORS. — Among the tractors employed in France, which are usually petrol or paraffin driven the following may be quoted :

1) The LEFÈVRE tractor is on the creeping track system. In the model shown at the trials at Choisy-le-Grand, in 1915, which has a steering axle with two wheels, the transmission and the mounting are simplified by the introduction of a new change speed gear which reduces the number of pairs of gears engaged to two at all speeds.

2) The GOUGIS tractor, with 4 cylinder petrol 15 H.P. engine with two 3 ft. driving wheels, and 0.22 m. tire and a steering wheel 0.55 m. in diameter. The weight is 1400 kg, the size, 3.40 m.  $\times$  1.75 m.  $\times$  1.60 m.

3) The DOISY winch-tractor is used for ploughing with cables, for harvesting (direct traction), carting and for driving machinery. The motor is 4 cylinder, 20 H.P. There are 3 speeds and a reverse. The cable, wound by the winch, has also 3 speeds : 0.40 m., 0.85 m. and 1 m. per second.

4) The CASE tractor (1) of which there are several types. The 10-20 H.P. tractor has 3 wheels, the front one, which is furnished with grips, is placed in the same line as the big driving wheel furnished with land grips. The motor has 4 vertical cylinders. The length of the wheel base is 1.92 m., the total length 3.80 m. and the width 1.70 m.

5) The AVERY tractor (2) is of American make and has the back wheels of very big diameter : 1.75 m., with very broad tires. The motor is 25 H. P. The weight of the tractor is 5190 kg. The size 4.50 m.  $\times$  2.30 m.  $\times$  2.80 m.

6) The TOURAND LATIL motor plough is composed of two separable parts, the tractor and the plough. For ploughing purposes the 2 portions form a complete whole capable of being driven by a single man. It has a chain drive. The back wheels are 1.10 m. in diameter and 0.27 m. wide ; the front wheels are 0.95 m. in diameter. The 4 cylinder engine runs at 1000 revolutions per minute. It has two speeds (3.500 km and 5.500 km) and a reverse. The plough is 5-furrow, joined to the chassis by means of a rocking lever which brings the pull to the centre of the chassis.

7) The AMANCO tractor, known in England as the "Overtime", is of American make. The motor (3) is 24 H.P. with 2 horizontal cylinders and uses paraffin. The two driving wheels at the back are 1.30 m. in height. The machine is guided by means of two chains winding around a horizontal winch which is worked by means of a steering wheel. A spring to take up shocks is placed between the extremity of each chain and the front axle.

8) The BARONCELLI tractor was tested in 1916, at Noisy-le-Grand. It has 3 wheels, the two back ones being driving wheels. The 4 vertical cylinder motor is placed above the back axle (fig. 5) ; note the starting crank *b*, the petrol tank *c*, and the radiator *d* of the SOLER type used on the Paris

(1) See *B.* 1914, No. 557 — *B.* March 1917, No. 274

(2) See *B.* June 1917, No. 670.

(3) See *B.* 1916, No. 896.

motor omnibuses. The transmission is contained in *e*, the differential in *f'* whence 2 chains drive each wheel. As one of these wheels is to run in the furrow, its axis is capable of vertical displacement in relation to the other wheel working on the smooth in order for the chassis to remain parallel with the ground: this displacement is obtained by means of the screw *g*, the nut of which is turned backwards and forwards by means of the mechanism *h*, worked by the motor; during displacement the hub turns in the curved groove *i*. The driving wheels can be fitted with grips *k*. About  $\frac{4}{5}$  ths. of the total weight being carried by the back axle, direct coupling from the rear of the chassis becomes impossible as the pull would be capable of upsetting the balance of the tractor and so tipping up the front wheel. To overcome this difficulty, the inventor has carried the pull of the coupling hook to the front by means of two rods fixed to two brackets *l* fixed below the chassis and in front of the driving wheel.

9) The SALVERT tractor (1) is carried in front by two large drums which are guided by means of chains winding round two horizontal winches, controlled by the steering wheel. The motor has 4 cylinders. The chassis is hung on plate springs both over the front rollers and over the axle of the driving wheels; this allows of a speed of 10 to 11 km. per hour on the road. In the fields the driving wheels are fitted with grips of 20 cms. projection.

10) The EMERSON tractor (2) is carried on three wheels, of which one is a big driving wheel at the back.

11) There are two distinct types of MOGUL tractor (2), one 16 and the other 25 H.P. The latter took part in the French trials in 1916.

12) The MISSVALLEY tractor (3) has a 4-cylinder motor making 800 revolutions. The speeds are 2.5 km. and 4 km. per hour.

Besides these tractors, the writer describes a motor tipping-waggon on the STERLING system.

RECENT EXPERIMENTS ON MECHANICAL CULTIVATION. — The writer mentions the various trials with tractors held in the spring of 1916, at Gournay-sur-Marne (4), Noisy le Grand and Provins. The following tables summarise the results in the petrol consumption tests and the main facts of working.

The figures in Table II are the maximum figures which should not be exceeded in practice.

The trials conducted last autumn in the neighbourhood of Paris, following the instructions of the Minister for Agriculture, were specially directed to studying the various existing agricultural machines capable of being replaced by tractors and similar inventions.

The trials were divided into two groups: 1) raising potatoes; 2) cultivation. For raising potatoes the firm of PILTER was the only one to compete and showed a machine with jointed forks of French make, drawn by a 16

(1) See *B.* June 1917, No. 577.

(2) See *B.* 1916, No. 670 — *B.* March 1917, No. 274.

(3) See *B.* 1916 No. 670.

(4) See *B.* 1916. No. 670.

TABLE I. — *Fuel consumption trials with motors running light.*

Tractors	Average number of revolutions per minute	Consumption of petrol per hour.
Mogul-16 H. P. . . . .	400	1.04 kg.
Mogul-25 H. P. . . . .	550	3.58
Emerson (carburettor A.) . . . .	800	2.50
» ( » F.) . . . .	800	3.00
Baroncelli . . . . .	700	6.68
De Salvart . . . . .	800	3.94

TABLE II. — *Consumption per hectare and per hour.*

Tractors	Order	Ploughing		Average speed of plough per hour. in metres	Average time required for turning seconds	Time required to plough 1 hectare hours and minutes	Area ploughed per hour	Consumption of petrol	
		Depth in cms.	Width of track in metres					per hour kg.	per hectare kg.
Mogul-16 H. P. . . . .	1	16.0	0.97	3 276	25	4.18	2 325	5.66	24.3
Mogul-25 H. P. . . . .	2	20.9	1.26	2 736	34	4.4	2 460	6.72	27.3
Emerson. . . . .	3	15.7	0.61	5 292	30	4.48	2 083	8.60	41.2
	4	22.7	0.58	2 592	30	9.12	1 087	5.40	49.6
	5	17.5	1.00	2 772	40	5.18	1 887	5.50	29.1
	6	15.0	0.94	3 600	25	4.8	2 421	6.90	28.5
	7	20.4	0.94	3 402	25	4.14	2 364	7.26	30.7
	8	13.0	0.94	2 772	30	4.25	1 886	7.86	40.9
	9	18.0	0.88	2 700	30	4.47	1 774	8.51	49.0
Baroncelli . . . . .	10	14.6	0.80	3 600	18	4.38	2 155	11.61	53.8
	11	15.4	1.00	2 664	31	5.12	1 923	9.52	49.5
	12	17.1	0.60	3 672	35	6.43	1 488	11.33	76.1
	13	26.7	0.65	2 268	38	9.29	1 054	8.26	78.3
De Salvart. . . . .	14	15.0	2.42	3 240	54	2.2	4 902	10.74	21.9
	15	17.6	2.40	3 132	54	2.5	4 784	13.20	27.5

H. P. Avery tractor. In the trials the tractor substituted a team moving at 0.83 m. per second, communicating to the forks of the potato raiser a speed at the circumference of 2.70 metres per second.

The cultivation tests were performed with apparatus belonging to the 3 following groups :

1) Riding ploughs driven direct or by cable, working one or more furrows, for ploughing with headlands, or for in and out ploughing.

2) Special purpose ploughs driven direct or by cable : cultivators, scarifiers or pulverizers, etc.

3) Machines for supplementary work, driven direct or by cable : harrows, rollers, clod-crushers, etc.

These machines have all given good results.



Several of them possess arrangements to allow of their being operated by disabled persons.

The writer records further trials carried out in the course of 1916, the results of which may be summarised as in Table III.

TABLE III. — *Trials during 1916.*

Districts	Tractors tested	Nature of work and soil	Time required to work 1 hectare (2.2 acres)	Consumption of fuel per hectare	Cost of fuel per hectare
Jolibois . . . .	Emerson-Mogul 16-25 H.P. Lefebvre	clay soil	6h. 20 to 9h. 55	41 to 139 litres of petrol	—
Avignon . . . .	Emerson-Mogul-Bull-Amanco	ploughing of stubble	2h. 17 to 3h. 20	18 to 27 litres of petrol 22.79 litres of paraffin	10.26 fr. to 17.54 fr.
	Emerson-Mogul-Bull-Amanco	depth 20 cms	3h. 36 to 4h. 22	27.45 litres to 37.80 litres of petrol 31.50 l. of paraffin	17.87 to 20.42 fr. 14.17 fr.
Toulouse . . . .	Baby-Bull - Mogul - 16 H. P. Emerson	depth 15 to 20 cms.	5h. to 11h. 6m.	40 to 70 litres of petrol	—
Tours . . . . .	Bull-Mogul 16 H. P.	depth 15 to 19 cm corn stubble	1972 to 2847 sq. metres per hour	22.40 to 44 litres of petrol 41.6 and 47.7 litres of paraffin	—
	Case 20 HP. and Emerson				
	Mogul and Amanco				

According to careful experiments carried out with a tractor belonging to the Syndicate for mechanical cultivation of Etampes, the cost price of ploughing about 9 hectares to a depth of 14 cms. was made up as follows :

Petrol . . . . .	350 litres	at 0.67 fr.	=	234.50 fr.
Oil . . . . .	24 »	» 1.50 »	=	36.00 »
Valvoline for transmission . . . . .	8 »	» 0.90 »	=	7.20 »
Grease . . . . .	2 »	» 1.50 »	=	3.00 »
Mechanic . . . . .	7 days	» 8.00 »	=	56.00 »
Assistant . . . . .	7 »	» 6.00 »	=	42.00 »
Depreciation and upkeep reckoned according to hours of actual work	45 hours	» 2.00 fr.	=	90.00 »
				468.70

The fuel consumption figures per hectares are :

Petrol . . . . .	39.32 litres
Lubricants: oil . . . . .	2.69 »
valvoline . . . . .	0.90 kg.
grease . . . . .	0.22 »
Cost of ploughing per hectare . . . . .	52.60 fr.

The writer describes the method for calculating the cost of ploughing used by M. de PONCINS (1).

EMPLOYMENT OF ELECTRICITY IN AGRICULTURE. — M. DANTIN describes what has been done recently in this connection. He states that the splitting up of land in France still forms an obstacle to the employment of electricity in agriculture. The power required to do all the work of a farm is comparatively small: 10 to 25 kilowatts per hectare yearly. But the installation will cost from 10 000 to 15 000 francs unless the farmer is situated within 3 or 4 km. from a high tension cable. It would be necessary for to cooperate in order to establish a distributing cable. A number of supply companies have already obtained a good many farmer customers, but more particularly for running electric motors to raise water for irrigation.

The writer records several applications of electricity to agriculture; among others he mentions an installation in a farm of 250 hectares, situated in the Department of the Eure, the electricity being generated by an 18 H. P. gas engine. This installation cost 16 250 fr. and the annual expenses are 1 964 fr., including interest and depreciation. The use of electricity has saved 4 000 fr. a year, of which 2 500 fr. for threshing.

Among collective enterprises, that of Eure-et-Loire mentioned by M. LEVY-SALVADOR in the *Revue Electrique* is said to have given the best results. This Co-operative Society was formed in 1916 among 88 farmers working 1100 hectares and extending over to 6 adjoining communes. The capital is 33 500 fr. divided into 25 fr. shares. The electric installation includes two 35 to 40 H. P. gas engines working the dynamos producing 460 volts. The accumulators have a capacity of 150 ampère hours.

During the first season, the receipts rose to 15 121 francs; in the second season they reached about 22 000 francs. The farmers made large savings on their farm-work, especially on threshing. This economy is calculated at 60%

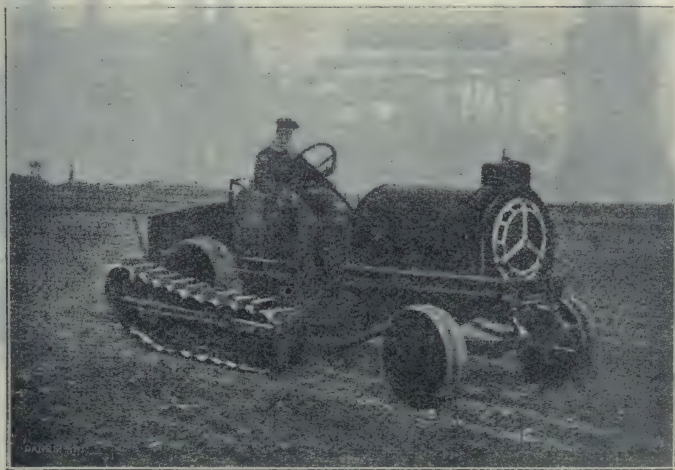


Fig. 1. — LEFÈVRE tractor.

(1) See B, 1916, No. 1207.

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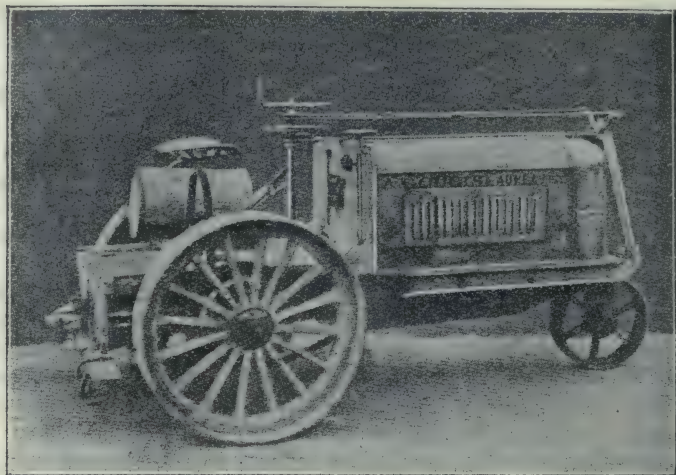


Fig. 2. — GOUGIS tractor.

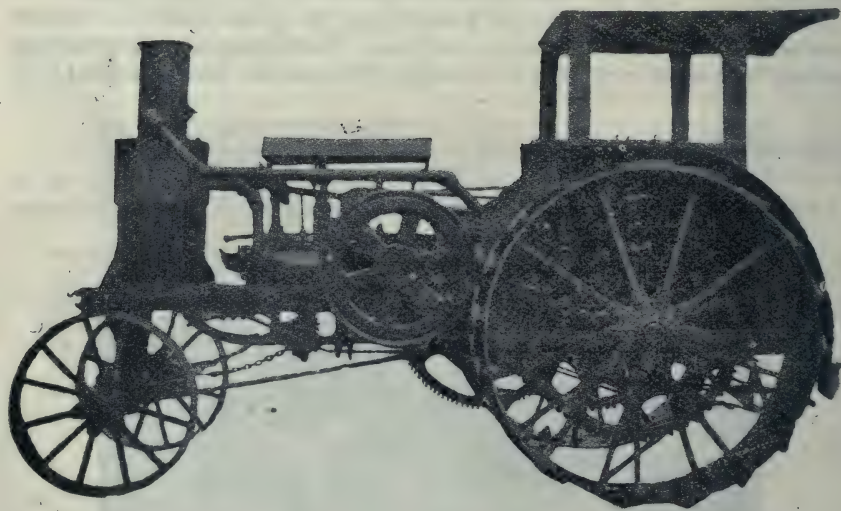


Fig. 3. — AVERY tractor.



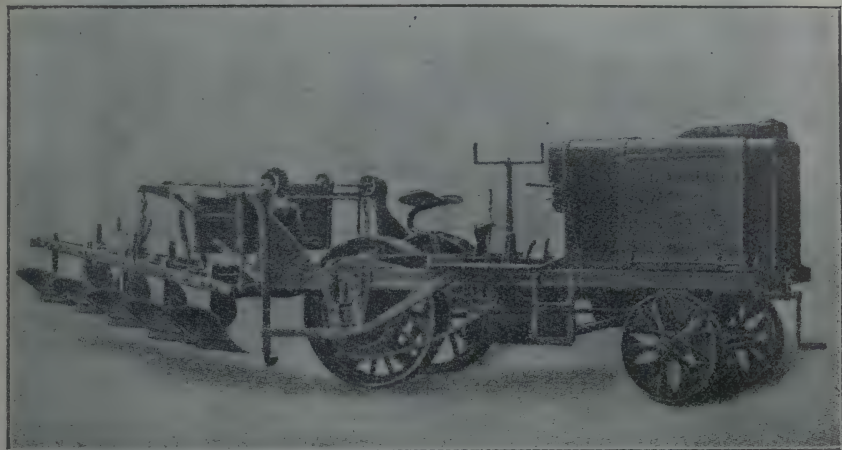


Fig. 4. — TOURAND LATIL Motor plough.

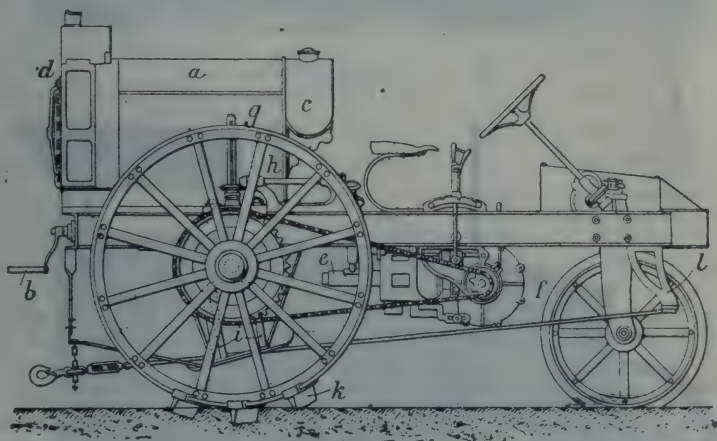


Fig. 5. — Side View of BARONCELLI tractor.

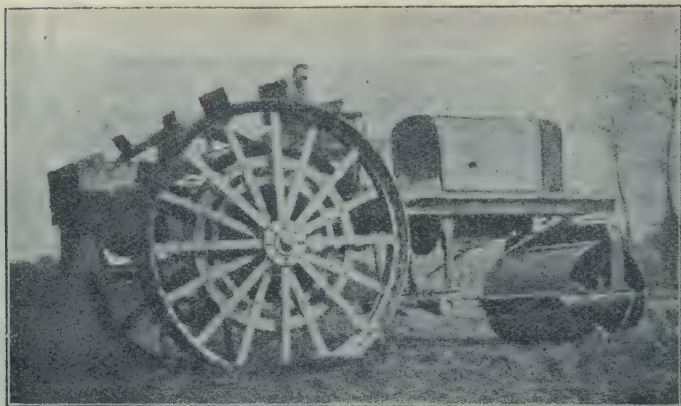


Fig. 6. — SALVERT tractor.

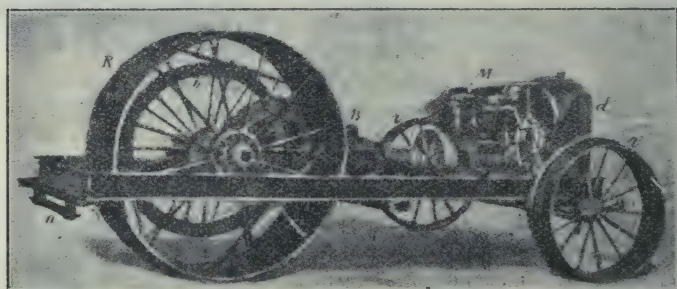


Fig. 7. — EMERSON tractor.

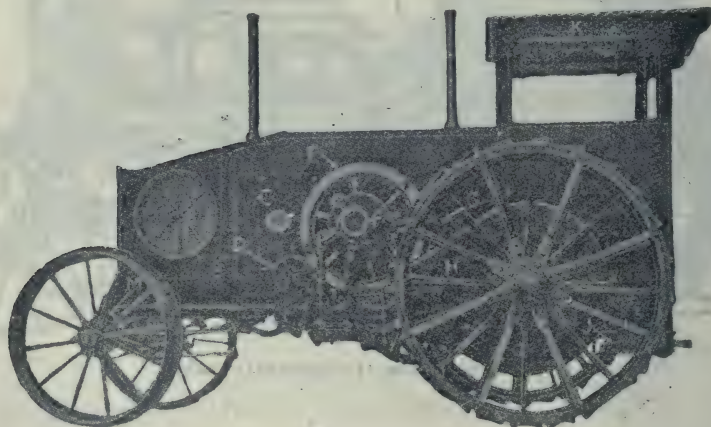


Fig. 8 — MÔGUL tractor.

754 - **The Actual Extent of the Use of Motor Tractors on American Farms.** — *The Economic World*, N. S. Vol. XLII, No. 14, pp. 482-483. New York, April 7, 1917.

An investigation recently conducted by the Office of Farm Management of the U. S. Department of Agriculture in cooperation with the Bureau of Crop Estimates has ascertained as closely as possible the number of gasoline and kerosene tractors which will actually be in use during the coming season in the various States. The 32 000 agents and correspondents of the Bureau of Crop Estimates were instructed to gather the figures for their respective districts not including in their returns steam driven tractors, tractors purchased but not delivered, tractors out of commission or not to be used this season or tractors primarily employed for road work or work other than farming. A compilation of the report showed a total of 34 371 gasoline or kerosene tractors, the actual ownership of which by farmers was clearly established and the intention to use which during the season of 1917 was fairly well ascertained.

The following table shows the number of tractors found in each of the States :

Alabama . . . .	313	Maine . . . . .	53	Ohio . . . . .	1305
Arizona . . . .	23	Maryland . . . .	190	Oklahoma . . . .	795
Arkansas . . . .	336	Massachusetts . .	91	Oregon . . . . .	318
California . . . .	1358	Michigan . . . . .	945	Pennsylvania . . .	595
Colorado . . . .	525	Minnesota . . . .	1575	Rhode Island . . .	30
Connecticut . . .	47	Mississippi . . . .	377	South Carolina . .	387
Delaware . . . .	34	Missouri . . . . .	1141	South Dakota . . .	1527
Florida . . . . .	71	Montana . . . . .	808	Tennessee . . . .	442
Georgia . . . . .	543	Nebraska . . . . .	1773	Texas . . . . .	2235
Idaho . . . . .	262	Nevada . . . . .	19	Utah . . . . .	88
Illinois . . . . .	3202	New Hampshire . .	23	Vermont . . . . .	75
Indiana . . . . .	1852	New Jersey . . . .	107	Virginia . . . . .	434
Iowa . . . . .	2223	New Mexico . . . .	83	Washington . . . .	209
Kansas . . . . .	2287	New York . . . . .	1210	West Virginia . . .	90
Kentucky . . . .	348	North Carolina . .	452	Wisconsin . . . . .	904
Louisiana . . . .	343	North Dakota . . .	2137	Wyoming . . . . .	186

755 - **The New Ford Tractor.** — I. *Le Génie Rural*, Year 9, No. 67, p. 13, 1 fig. Paris, 1917. — II. *The Implement and Machinery Review*, Vol. 43, No. 507, pp. 293-294, 1 fig. London, July 1, 1917.

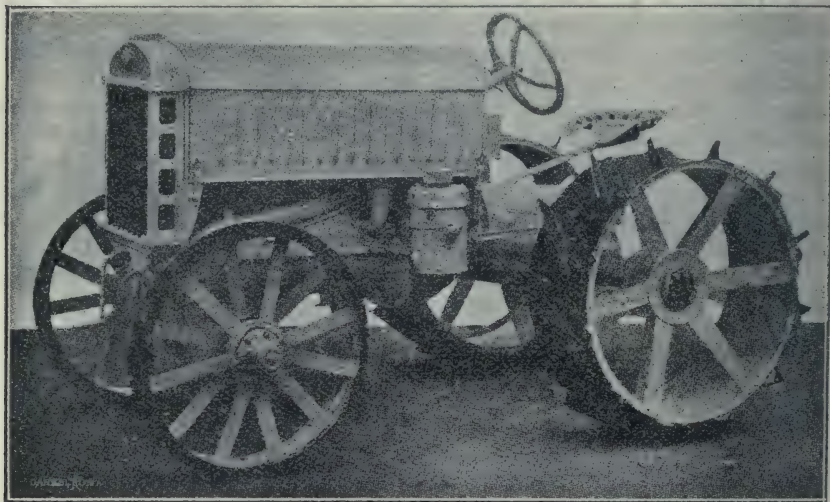
The Ford tractor, which has recently been tested with good results by the Royal Agricultural Society of England, has the following chief points:

The tractor (fig. 1) has no real chassis : the radiator is fixed directly to the motor which is supported by arms attached to the axle. The wheels are of steel and all the working parts are completely closed in to protect them from dust and mud.

The tractor weighs less than a ton ; it has the special FORD magneto



and a thermosiphon cooler, etc. The motor is a large size of that used for the automobiles; it has 4 cylinders (bore 102 mm., stroke 114 mm.) giving 20 brake H.P. with a 10 H.P. pull at the draw-bar. There are 3 speeds and a reverse; the drive being of the back-axle type. The tractor does about 4



FORD Tractor.

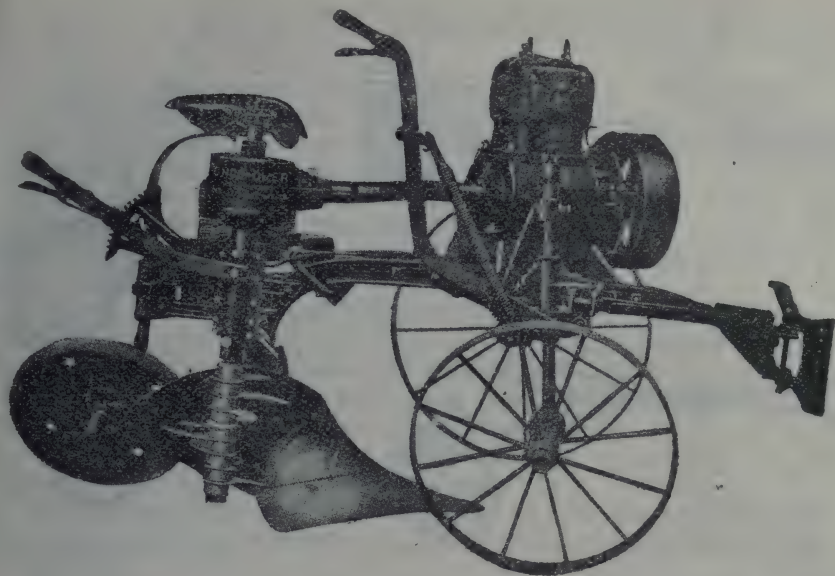
miles an hour on the road and 2 to 3 when in the field. The steering is by a bevel gear. Searchlights for night working are lit from the magneto.

The tractor is built solidly and simply, and is said to cost about 300 dollars, though the price has not yet been fixed.

756 - The "Once-Over" Tiller. — *The Implement and Machinery Review*, Vol. 43, No. 506, p. 176. London, June 1, 1917.

This tiller is quickly and easily adapted to an ordinary riding plough and consists of a steel tooth rotor, set to the right of the share and mould board. The rotor is geared at the top of the shaft of a small gasoline motor which whirls the rotor at about 500 revolutions per minute. The rapidly revolving rotor catches the liftings from the plough just as the soil turns over from the mouldboard, and the teeth of the rotor shred and tear the weeds, grass, roots, fertiliser and soil into a finely pulverised mass, throwing it out behind, and making, it is claimed, a perfect and mellow seedbed for the sowing of any crop.

The machine, which is made by the SCIENTIFIC FARMING MACHINERY Co., Minneapolis, U. S. A., is said to have given satisfactory results in tests made by some of the most important agricultural colleges in the United States.



The "Once-Over" tiller.

757 - **Devices for Disabled Farm-hands.** — GUILLAUME, A. C., in *La Nature*, No. 2275, pp. 278-283. Paris, May 5, 1917.

In France, 70 % of the total number of labourers are employed on farm work, and it is therefore logical to suppose that the same proportion will occur among the wounded.

The writer reviews the various methods for making use of disabled men according to the type of and the possibility of their improvement. With regard to those who have been wounded in the lower limbs it would be best to eliminate them from work which required much walking or rapid movement. They could be utilised either for the indoor work of the farm or as drivers of tractors, or again for working stationary machinery such as threshers.

On the other hand, the place for a man with a disabled arm is in the fields: with the help of an artificial aid he is capable of performing various kinds of work in turn; drive a team, reap, even dig and look after crops and trees generally.

The improvement of injuries depends upon medical or surgical treatment and upon education. The latter involves the following:

a) Education of the healthy limb to act as leading aid. This will be the personal care of the wounded man himself;

b) The modification of the stump, which forms a kind of preparation of the patient before receiving his apparatus. This is the domain of the doctor or surgeon;

c) The choice of the apparatus requires exceedingly careful study.

The devices for the lower limbs differ very little from those in ordinary

*Devices for Disabled Farm-hands.*

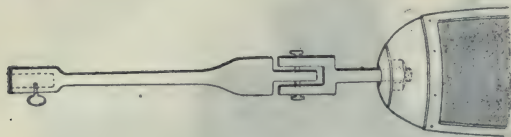


Fig. 1. — Forearm with elbow joint.



Fig. 2. — Elbow joint with bol for fixing arm at different anglet.

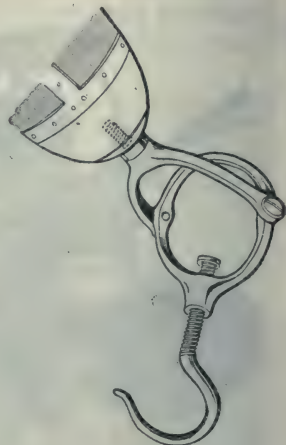


Fig. 3. — Hook for navy.

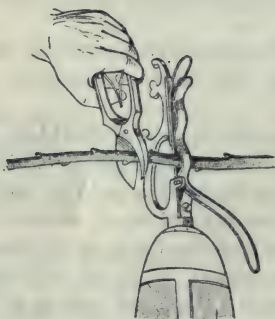


Fig. 5. — Hand for vine-dresser.

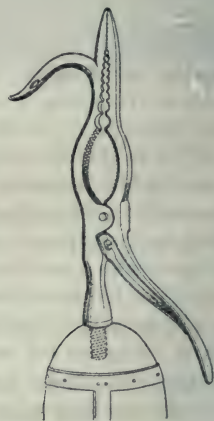


Fig. 4. — Hand for pruning.



Fig. 6. — For holding reins.

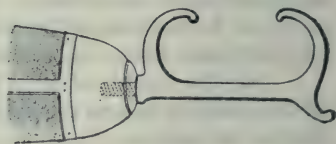


Fig. 7. — Hook for driver of tractor.



use. They should be strong, not too heavy, and with interchangeable parts, easy to procure at a minimum expense.

A longer description is given of the devices for arms. These are highly specialised for agricultural use. The artificial aid consists of a cap fitting over the damaged part and of a stem ending in a socket to receive a hook or other substitute for a hand.

Fig. 1 shows an apparatus for an arm amputated about a third of the way down. It consists of : 1) a stem replacing part of the humerus ; 2) a joint ; 3) a stem representing the bone of the forearm and ending in a socket for artificial hand.

Instead of the straps which serve for a hand, the JULLIEN (1) tool-holder is preferable for the farm labourer. The BOURREAU series of hands permits of a much greater number of different actions than the other systems. They fit into the tool-holder and have the advantage of being interchangeable according to the different requirements.

BOURREAU has thought out 6 different hands, of which 5 are for working purposes and 1 one for use when at rest.

The working hands are : for navvy (fig. 3), for vine-dresser and forester (fig. 4 and 5), for driver of vehicles (fig. 6) and two hands for drivers of tractors (fig. 7).

These devices allow all wrist movements to be copied. The hand for the navvy is formed of a moveable ring furnished with a hook, which can either swing or be fixed. It can serve for a number of actions: digging, ploughing, pushing a wheel-barrow, pulling a hand-cart, working a pump, holding a pail, a basket, etc., loading manure, driving a cart.

For driving a team the hook is replaced by a reingrip which allows the driver to drop the reins easily when necessary. The hands are capable of being used for pruning and certain indoor jobs, such as the preparation of scions for the vine-dresser, cuttings for the gardener, etc.

The object of the double hook for motor-drivers is to allow of the movements of pushing and pulling and such other actions as are required for working the levers.

## 758 - Review of Patents.

### *Tillage Machines and Implements.*

Austria	73 792 — 73 822. Motor ploughs.
	73 793. Land-grips for motor plough wheels.
Canada	174 387. Scraper for coulters.
	174 404. Cultivator.
	174 463. Coulters.
	174 861. Plough mechanism.
	175 051. Scraper for disc ploughs.
	175 374. Harrow.
France	478 068. Plough with adjustable stilts for various agricultural operations.
Italy	155 226. Single-cable, funicular tractor plough.
Switzerland	75 312. Device for extirpating vine stumps and the like.

(1) See B. June 1917, No 578.

(Ed.)

United Kingdom 104 156. Plough.

United States 1 225 066 — 1 226 754 — 1 227 294. Cotton choppers.

1 225 204 — 1 225 904. Harrows.

1 225 233 — 1 226 793. Disc-ploughs.

1 225 268. Motor plough tractor.

1 225 339. Autoplough.

1 225 367. Harrow-tooth.

1 225 339. Combined mulching and levelling attachment for ploughs.

1 225 400. Levelling and mulching attachment for ploughs.

1 225 423. Agricultural implement.

1 225 659. Cultivator shovel.

1 225 853 — 1 226 450. Cultivators.

1 225 912. Combined tractor, roller and plough.

1 225 949. Coulter.

1 226 200. Agricultural tractor.

1 226 425. Clearing plough.

1 226 493. Tilling machine.

1 226 510. Plough.

1 226 920. Agricultural implement.

1 226 965. Attachment to ploughstock.

1 227 089. Ground cultivators.

1 227 166. Rotary weeder and cultivator.

1 227 237. Gangplough.

1 227 349. Reversible plough.

1 227 508. Plough attachment.

#### *Manures and Manure Distributors.*

Canada 174 307 — 174 898. Manure spreaders.

Italy 155488. Process for manufacture of a new fertilizer.

United Kingdom 105 399. Manure and the like distributors.

United States 1 224 903 — 1 226 746. Manure spreaders.

1 225 873. Fertilizer distributor.

1 226 125. Manure loader.

#### *Drills and Seeding Machines.*

Austria 73 791. Seeding machine.

Canada 714 962. Seed drill.

United States 1 226 707. Grain drill.

1 226 800. Garden-seeder.

1 227 018. Planter.

#### *Cultivation.*

Austria 73 738. Machine hoe.

France 456 176. Moveable panels for protecting fruit trees against frost.

United States 1 224 975. Rotary weeder and cultivator.

1 225 378. Potato-hilling plough.

1 225 386. Hoe.

#### *Control of Diseases and Pests of Plants.*

Austria 73 794. Fly-trap.

73 834. Method and device for destroying vermin.

Canada 174 599. Trap.

*Reapers, Mowers, and Harvesting Machines.*

- Canada 175 054. Stooker.  
 175 092. Drive mechanism for binder reel shafts.  
 175 320. Lawn trimmer.  
 175 348. Harvester.
- United Kingdom 104 071. Harvesting machines.  
 104 165. Lawn mowers.
- United States 1 225 193. Cotton picker.  
 1 225 598. Disk guard for grain binders.  
 1 225 806 — 1 226 719. Snapping-rolls for corn huskers, pickers, and the like.  
 1 225 807 — 1 226 718. Corn Huskers.  
 1 226 369 — 1 226 371 — 1 226 373. Grain shockers.  
 1 226 376. Binding mechanism.  
 1 226 573. Bean-vine gathering apparatus.  
 1 226 629. Head holder for grain binders.  
 1 227 325. Corn harvester.  
 1 227 410. Sharpening attachment for mowing machines.

*Machines for Lifting root Crops.*

- United States 1 225 759. Beet toppler.  
 1 225 841. Beet and vegetable toppler.

*Threshing Machines.*

- Canada 175 176. Tooth for threshing machine.
- Italy 155 811. Self-feeding device for threshing machines.
- United States 1 226 865. Threshing machine.

*Machines and Implements for the Preparation and Storage of Grain, Fodder, etc.*

- Canada 174 265. Drying apparatus.  
 174 359. Whippetree.  
 174 502. Grain door.  
 174 572. Feed device for straw cutters.  
 174 716 — 174 725. Bag holders.  
 175 077. Hay stacking implement.  
 175 304. Silo.
- Switzerland 75 309. Device for covering hay stacks.  
 75 310. Device providing for the escape of gas from heated hay.
- United Kingdom 105 626. Drying apparatus.
- United States 1 225 004. Hay rack.  
 1 225 031. Grain handling device.  
 1 227 058. Hay bunching machine.  
 1 227 343. Sheaf loader.

*Forestry.*

- United States 1 225 432. Brush rake.

*Steering and Traction Agricultural Machines.*

- France 483 105. Motor lorry.
- United States 1 227 005 — 1 227 016. Tractors.  
 1 227 389. Agricultural tractor.



*Housing of Livestock.*

- France 478 063. New agricultural antiseptic product and process for manufacturing it.  
 Switzerland 75 308. Process for preparation of maize straw as litter.  
 United Kingdom 105 525. Insecticides, sheep dips, etc.

*Poultry Farming.*

- Austria 73 835. Poultry feeding device.  
 United Kingdom 104 413. Poultry feeders.  
 105 802. Food for poultry, etc.  
 United States 1 225 063. Chicken brooder and grain sprouter.

*Industries Depending on Plant Products.*

- Canada 175 252. Tobacco leaf stemming machine.

*Dairying.*

- Canada 174 718. Pump for milking machine.  
 175 133. Butter making machine.  
 175 311. Churn.  
 United Kingdom 105 799. Filling bottles, jars, cans, etc.

*Farm Buildings. etc.*

- Canada 174 381 — 174 935. Window ventilators.  
 174 506. Gate hinge.  
 175 289. Fence.  
 175 304. Silo.  
 Switzerland 75 311. Silo for sweet ensilage.

*Miscellaneous.*

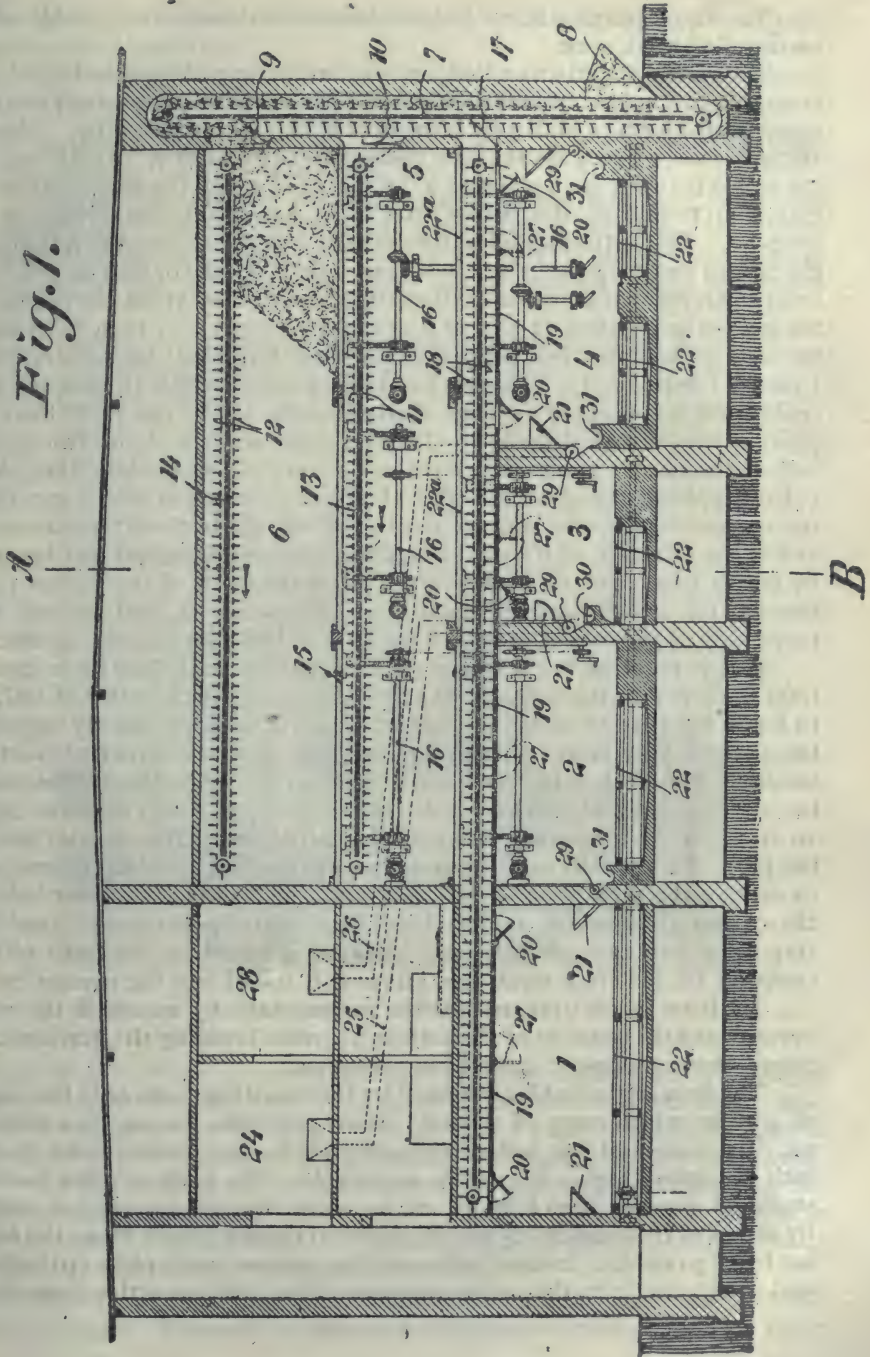
- Canada 174 644. Oil feeder.  
 175 067. Saddle.  
 175 312. Harness.  
 175 695. Ice manufacture.  
 United Kingdom 105 834. Slaughtering cattle.

759 - **Mechanical Installation for a Stable (Naegeli Patent).** — *Le Génie Rural*, Year 9. No. 68, pp. 12-13, figs. 4. Paris, 1917.

The object of this invention is to equip a stable in such a way as to reduce the amount of labour to a minimum. It is particularly intended for carrying food and litter and distributing same among the stores, at the same time removing the manure by means of endless conveyors, elevators, etc.

The essential feature of the invention is that the carriers, bearing claws or teeth of the usual type, are arranged in such a way that the upper belt is situated above the ceiling or roof and the lower one beneath it. The lower belt distributes the food and litter carried up by an elevator; the upper one removes the food placed in the space above. Above the upper belt of the conveyors and in the direction of their movement there are placed a number of moveable bars which, in the raised position, keep the material above out of the reach of the teeth of the conveyors, but when lowered intercept with these teeth in such a way that portions of the material are caught up and carried away.

Fig. 1.



Side view of an installation.



The accompanying figure 1 shows longitudinal section of a stable with an installation at work.

The stalls, properly so called, are situated at ground level and fitted up according to the kind of animal which is to be stabled there. Stall 1 is for sheep, stall 2 for pigs, stall 3 for horses and stall 4 for horned cattle. Above the stables, 2, 3 and 4 are the lofts containing hay or straw. At the end of the stable building is an elevator 7, by means of which the hay or straw is carried up to the loft, the food or litter being conveyed to the elevator by a hopper 8. The teeth of this elevator seize the material and convey it through the traps 9 and 10 of the loft. These traps can be opened or shut at will. In order to prevent the material accumulating around these traps, conveyors on the endless belt system 11 and 12 provided with teeth have been fixed near the ceiling, the upper belt being above and the lower belt beneath, ceilings 13 and 14 respectively. The teeth of the lower belt which are beneath the ceiling and travel in the direction marked by the arrows distribute the material at the bottom of the lofts. In order to prevent the teeth of the upper belt of the carrier 11 catching up the contents of loft 6 while filling loft 5, bars 15, have been fixed above the belt and arranged in such a way that the spaces between the bars are situated above the teeth of the carrier 11 and in the direction of its movement. Each bar can be raised and lowered by means of a winch 16 in such a way that the teeth of the carrier pass through the spaces between the bars of the grating 15, and through the movement of the carrier, carry off the food or litter which is in the loft.

If it is required to carry a portion of the material (hay for instance) from the loft 6 to the mangers, the first thing to do if the loft 6 is full, is to lower the portion of the grating 15 which is situated directly opposite the elevator 7 by means of the winch 16; this done, the carrier 13 is set in motion. The teeth of the carrier will then carry away portions of the lower layer of the material (hay) towards the elevator 7 passing above the traps 10 arranged in the position shown by the dotted line. The elevator lowers the product till it falls over the trap 17 on to the belt 18 which is arranged in exactly the same way as the conveyor 11. Beneath the lower belt of the carrier 18, a ceiling 12 has been fixed with openings 20 closed by trap-doors and through which the material is forced by the teeth of the conveyor 18, the traps mentioned allowing it to fall into the manger 21.

The litter in loft 6 is carried to the various stalls by means of the conveyor 16 and the traps 27 of the ceiling 19, after lowering the gratings 22a placed above the upper apron of the conveyor.

The floor of the stables is formed by the travelling belts 22 in the shape of gratings which carry off the used straw and stable manure to a manure pit. The motion of this belt should naturally be very slow in order to disturb the animals upon it as little as possible. The grain or other feeding stuffs are removed from lofts 28 and 24, where they are prepared or stored, by means of the conduits 25 and 26 joined to funnels placed above the feeding boxes 30 and 31. In these latter revolves a screw which picks up the food and distributed it to the various mangers after their respective traps have



been opened. However, this method of distributing the food is not a part of the actual invention.

The whole of the apparatus is driven by electricity and the mechanism can be put out of gear automatically at fixed times.

760 - **Reinforced Concrete Buildings.** — ESPIÉALLIER, G., in *Le Génie Civil*, Vol. I, XX No. 20, pp. 322-324, 4 figs. Paris, May 19, 1917.

Amongst materials for use in constructing farm buildings, the writer mentions reinforced concrete, which has many advantages. Its utility is very wide and its price has not become too high ; if metal is required in the construction, the proportion used can be reduced within reasonable



Construction of a concrete house.

limits so as to form an economical whole. The concrete can be made on the spot, and often the gravel and sand, which constitute the heavy part of the cement, are to be found close at hand, which reduces the cost of carriage. In addition, concrete construction work can be quickly carried out.

The work can be carried out in two ways : either by moulding on the spot or constructing by members already moulded. Moulding on the spot is the simplest, giving, moreover, a building that has the advantage of being in one piece and offering the greatest resistance.

The large amount of wood required for the moulds represents a serious disadvantage. Amongst the houses moulded in one piece, the writer men-

tions the HARMS and SMALL "moulded house" ("maison coulé"). The procedure is to pour a special concrete directly into a mould whose metal parts completely cover the vertical walls, both inside and outside. The floors are formed by hollow reinforced concrete rafters, prepared previously and laid in position during the construction of the mould. When the moulds are in place, the concrete is poured in, the concrete maker being mounted at the top of the wall, so as to give an almost continuous supply without it being needful to change the position of the machine. The cement should be sufficiently fluid to penetrate everywhere and to spread in horizontal layers. To prevent the heavy materials separating out in the fall from the top of the walls, certain colloidal substances are added to give sufficient viscosity to the mixture.

By this process, the house can be finished and the moulding removed in about a fortnight. The chief disadvantage is that the mouldings require such a large amount of material. If only one house is to be built, the cost price would be much increased by the cost of carriage of the moulds. This method, therefore, seems most suitable for the reconstruction of a village or a workmen's quarter, made up of similar houses.

Various contractors have suggested using previously made units of reinforced concrete to form buildings that could be taken to pieces when finished with. The writer describes the system used by the two firms of contractors, A. BONNA, and SOULAT, for building houses by means of reinforced concrete units, the walls being double, which can be obtained by using reinforced plaster or plaster slabs as a lining inside the house.

761 - **The New Decauville Cement Brick.** — LANORVILLE, GEORGES, in *La Nature*, No. 2278, pp. 326-329. Paris, May 26, 1917.

M. DECAUVILLE has invented a new brick already used with success in constructing water-wings, and which will be very useful in constructing farm buildings cheaply and rapidly. The brick (fig. 1) can be made on the spot. It is made of mortar, little moistened, and composed of sand and cement. It measures about 9 ins. long on the broad face, about 8 ins. on the small face, and  $5\frac{1}{2}$  ins. high; the thickness varies from 3 to 4 ins. in the various types. It is pierced vertically with two  $\frac{3}{4}$  inch holes to receive the iron wires used for assembling the bricks. Each brick has 2 grooves on both upper and lower faces. The bricks are made by a rotary press, delivering about 1800 bricks in a 10 hour working day, 3 workmen being required.

For building, 3 types of brick are used: 1) sand and cement, 4 inches thick, weighing 180 kg. to the sq. metre (these bricks can be used, as has been done, for building walls 16 in. thick formed of 2 rows of bricks, the hollow interior being filled with powdered forge-scales); 2) sand and cement  $3\frac{1}{2}$  ins. thick, weighing 150 kg. per sq. metre for lighter work; 3) forge-scales and cement  $3\frac{1}{2}$  ins. thick, weighing 105 kg. per sq. metre. These lighter bricks are suitable for building partition walls.

Iron wire of  $\frac{1}{8}$  inch gauge is used in assembling the bricks. The wire is cut in lengths being multiples of from 4 to 7 times the height of the brick.

The wires are placed in the holes of the bricks as the wall gradually rises. Two wires of the same length should never be placed together. A wall of extreme solidity and rigidity is thus constructed in a remarkably short time. The 2 grooves on the upper and lower surfaces of each brick may be filled with a light mortar or used to contain iron wire to join the angles

*New DECAUVILLE Cement Brick.*



Fig. 1.

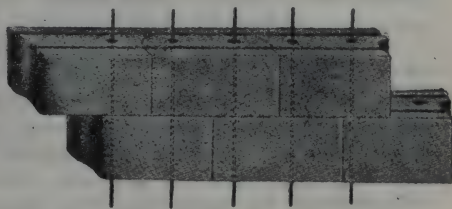


Fig. 2.

where a 6 inch iron standard can be fixed to the posts placed for the wood-work or openings. The angle bricks can be replaced by angle-blocks made in special moulds.

The special form of this easily-made brick, its low cost and its many applications, appear to justify its existence.

## RURAL ECONOMICS.

762 - **Labour Requirements of Crop Production.** — COOPER, T. P., PECK, F. W. and BOSS, A., in *The University of Minnesota Agricultural Experiment Station, Bulletin* No. 157 (Division of Agronomy and Farm Management), pp. 1-55. University Farm, St. Paul, Minnesota, March, 1916.

The cost of producing farm products under actual farm conditions has been studied at the University of Minnesota Experiment Station for more than 10 years (1). The data thus obtained have been used to determine the actual labour requirements of farm crops in terms of man and horse

(1) Cf. HAYS, W. M. and PARKER, E. C., *The Cost of Farm Products*, in *U. S. Dept. of Agriculture, Bureau of Statistics, Bull.* 48, and *Minnesota Experiment Station Bull.* 97, 1906.

PARKER, E. C. and COOPER, THOMAS, *The Cost of Producing Minnesota Farm Products*, *U. S. Dept. of Agriculture, Bureau of Statistics, Bull.* 73, and *Minnesota Experiment Station Bull.* 117, 1910.

COOPER, THOMAS, *The Cost of Minnesota Dairy Products*, *U. S. Dept. of Agriculture, Bureau of Statistics, Bull.* 88, and *Minnesota Experiment Station, Bull.* 124, 1911.

PECK, F. W., *The Cost of Producing Minnesota Farm Products, 1908-1912*, *Minnesota Experiment Station, Bull.* 145, 1915.



hours per acre and to define some of the principles underlying the use of man labour on the farm, so as to furnish a basis which will allow a better estimation of the cost of production.

The data refer to 8 farms at Northfield, Rice County for the south-eastern part of the State, 8 at Marshall, Lyon County, for the south-western part, and 8 at Halstad, Norman County, for the northwestern part; a large grain farm of 1920 acres in Norman County was also included. When the cost of production studies were started in 1902, the number of farms chosen in each of the above-mentioned districts was 15, but this number was subsequently reduced to 8 in each locality. The Northfield group includes very different types of farms with dairy products as the principal source of livestock income. They average about 175 acres and are considered typical farms in production and operation.

The land is rolling but well-drained, of friable loam with a clay subsoil, and responds readily to cultivation. The farms of the Marshall group are larger, averaging about 325 acres with but slight variations in area. The livestock income is derived chiefly from beef cattle and hogs, with some cows and sheep. The land is practically level, broken by sloughs and pot holes. The soil is easily worked loam, 4 horses doing as much as 5 at Halstad. The Halstad farms have an average area of 300 acres. The soil is a heavy clay loam. At one time, grain was grown here, but, during the period of the studies, a rapid transition to dairying and hog-raising took place. The large farm of 1920 acres was primarily a grain farm with practically no income from livestock.

Table I shows the average acreage of each crop in the 3 groups of farms:

TABLE I. — *Acreage of each crop.*

Crop	Northfield group	Marshall group	Halstad group
	8 year average Acres	5 year average Acres	8 year average Acres
Wheat . . . . .	6.7	33.3	92.7
Oats . . . . .	55.1	45.5	25.6
Barley . . . . .	9.2	32.2	36.2
Succotash . . . . .	7.1	—	—
Flax . . . . .	—	—	10.6
Corn . . . . .	28.1	52.9	12.8
Hay . . . . .	23.2	45.9	44.2
Pasture . . . . .	33.8	60.4	51.7
Minor crops . . . . .	5.3	12.8	6.1
Garden . . . . .	1.5	1.9	1.2
Farmstead . . . . .	2.9	5.3	6.2
Waste . . . . .	3.5	34.0	17.4
Total . . . . .	176.4	324.2	304.7

Table II gives the type of livestock on the farm.

TABLE II. — *Average number of livestock per farm.*

Livestock	Northfield	Marshall	Halstad	1920-Acre farm.
Horses . . . . .	6.9	10.2	8.9	48.5
Cows . . . . .	13.0	10.1	8.8	8.5
Miscellaneous cattle . . . . .	12.1	16.7	11.7	15.4
Swine . . . . .	16.1	32.7	5.1	16.8
Poultry . . . . .	118.4	127.6	88.3	110.0
Sheep . . . . .	69.5	55.5	25.7	—

USE OF LABOUR. — The productivity of labour may be increased in 4 ways: 1) by organising the farm so that labour may be used productively throughout the year; 2) by improving the yielding power of the soil by crop rotation or by the application of fertilisers and manures; 3) by maintaining more productive kinds of livestock so as to use labour profitably during the months when crop labour is not demanded; 4) by using large machines and mechanical power so as to increase the amount of work performed by each unit of labour. Whereas this last method is generally adopted by farmers in the north-west of the United States, the first 3 have not yet been put to so much use as they should in the eventual increase of the productivity of labour.

An examination of the average maximum and minimum number of hours of work done by one man during the different months of the year in the 3 groups, from 1905-1912, shows that, at Northfield, the greatest deviation from the average (12 %) is in February, while, from April to October, there is approximately only 40 hour's difference per month.

At Halstad, on the other hand, the deviations between the active and inactive months amount to 52 hours a month per man. The general averages show that the nominal amount of labour to be expected from a man per month is about 300 hours, including crop and livestock labour.

Table III gives the distribution in labour in percentages in the 3 groups of farms, for crops, livestock, horses and miscellaneous labour.

TABLE III. — *Distribution of labour of man and horses in the 3 groups:*

	Northfield		Marshall		Halstad		1920-acre farm	
	Man	Horse	Man	Horse	Man	Horse	Man	Horse
	per cent.	per cent.	per cent.	per cent.	per cent.	per cent.	per cent.	per cent.
Crop . . . . .	36.4	75.8	44.3	79.9	39.7	83.7	48.4	84.2
Productive Livestock.	37.2	6.8	25.3	5.5	27.8	4.0	10.0	0.5
Work Horses . . .	9.0	5.7	11.8	2.0	15.2	2.1	20.1	2.4
Miscellaneous . . . .	17.4	11.7	18.6	12.6	17.3	10.2	21.5	12.9
<i>Total . . .</i>	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

The total number of working hours of men and horses during the various months of the year is summarised in Table IV. (The authors also give the distribution per crop, for livestock, permanent improvements, maintenance, and household and personal requirements).

As these data on the number of working hours per man and per horse represent an average of 8 years, they may be considered as being uninfluenced by seasonal changes, and may be applied to all districts where farms are worked on similar lines. In the Northfield group 6330 hours of labour are required annually. If the proprietor himself does 3453 hours annually there remain 2777 to be performed either by hired labour or by a member of the proprietor's household.

The effects of the single-cropping system on the yearly distribution of labour is well illustrated by the special grain farm. On this farm 2347 hours of labour requiring 8 men are necessary in the 2 spring months, in August, 4191 hours and 13 men are necessary, whereas in September and October an average of 12 men is necessary. August, September and October require 58 % more labour than April and May. A similar increase is demanded from the horses. On the Northfield farms this increase is only 19 % for men and almost nil for horses. The Halstad farms, which also tend towards single cropping, show an increase of 30 %. Taking into consideration the number of hours devoted to crops, the percentages given in Table V are obtained; these show the amount of time each labourer can devote to crops.

TABLE IV. — (*Average for 1905-1912*). *Total hours of labour performed by men and horses per farm per month, in the 3 groups.*

Month	Northfield		Marshall		Halstad		1920-Acre farm	
	Man	Horse	Man	Horse	Man	Horse	Man	Horse
January . . . . .	345.8	132.5	340.5	164.8	360.8	150.4	513.8	153.0
February . . . . .	336.4	131.7	346.3	173.9	358.0	146.5	488.8	134.4
March . . . . .	423.4	211.3	467.9	340.2	442.8	137.6	809.1	492.2
April . . . . .	583.7	633.6	565.8	775.4	578.3	731.9	2 443.1	3 592.6
May . . . . .	577.4	622.8	613.9	917.6	637.8	881.0	2 251.4	4 964.2
June . . . . .	605.8	479.6	661.3	706.1	620.5	578.4	2 355.4	3 302.7
July . . . . .	665.9	556.6	773.0	871.5	805.1	744.6	2 753.0	3 012.7
August . . . . .	719.7	636.2	838.9	1 016.0	890.6	1 097.1	4 191.3	6 540.4
September . . . . .	569.8	576.4	682.6	935.5	768.2	1 233.1	3 560.2	7 221.5
October . . . . .	604.2	584.9	639.8	879.8	714.7	1 107.0	3 359.6	7 169.2
November . . . . .	516.5	417.0	581.9	701.6	516.7	372.3	1 947.5	2 736.9
December . . . . .	384.6	171.4	419.6	305.2	370.5	142.0	527.0	113.5
<i>Total . . . . .</i>	<b>6333.2</b>	<b>5 154.0</b>	<b>6 931.5</b>	<b>7 787.6</b>	<b>7 063.9</b>	<b>7 321.9</b>	<b>25 200.0</b>	<b>39 433.3</b>

During July, August, September and October about 50 to 75 % of the total labour must be given up to crops. In grain-growing districts where dairy cows are kept, winter milking is an advantage.

On diversified farms, during August and September, about 55 % of the labourer's time is given up to crops. On the specialised grain farm this figure rises to as much as 81 % in September. During the spring months a corresponding difference is noted, due partly, on the mixed farms, to a greater proportion of labour being devoted to livestock, whereas, on grain farms, the labour not taken up by crops is used in the care of the horses and general upkeep of the farm. On the 1920 acre farm, 67 % of the labour devoted to livestock is employed in the care of work horses, which, though maintained exclusively for productive enterprises, are not themselves directly productive. On the Halstad farms this percentage is only 35.3 %, on the Marshall farms, 31.8 %, on the Northfield farms only 19.5 %.

TABLE V. — *Hours per man devoted to crops, and relation of crop labour to total labour performed.*

Month	Northfield average of 64 farms		Marshall average of 41 farms		Halstad average of 58 farms		1920-Acre farm
	Available	Per cent.	Available	Per cent.	Available	Per cent.	Per cent.
	hours	of total	hours	of total	hours	of total	of total hours available
April . . . . .	117	38	121	42	113	39	42
May . . . . .	108	36	129	43	114	37	53
June . . . . .	81	27	106	36	87	30	33
July . . . . .	150	50	172	57	116	54	46
August . . . . .	174	55	193	63	205	65	75
September . . . . .	152	52	165	56	199	64	81
October . . . . .	151	49	141	50	148	47	45



TABLE VI. — *Hours per acre required from men and horses in the 3 groups for producing spring wheat in soil ploughed in autumn (1).*

Operation	Northfield 7 year average		Marshall 7 year average		Halstad 10 year average	
	Hours per acre		Hours per acre		Hours per acre	
	Man	Horse	Man	Horse	Man	Horse
Ploughing . . . . .	3.71	10.47	2.89	10.74	2.48	11.18
Manuring . . . . .	2.12	3.95	1.81	3.92	0.96	1.84
Hauling seed . . . . .	0.12	0.20	0.09	0.19	—	—
Cleaning seed . . . . .	0.32	—	0.28	—	0.27	—
Harrowing (2) . . . . .	1.20	2.59	0.42	1.55	0.72	2.71
Disking (3) . . . . .	0.76	2.26	0.69	2.69	0.70	2.81
Seeding . . . . .	0.66	1.98	0.59	2.18	0.65	2.53
Cutting . . . . .	1.04	2.99	0.86	3.05	0.87	3.05
Shocking . . . . .	1.21	—	0.97	—	1.03	—
Shock-threshing . . . . .	2.51	2.66	2.79	4.24	2.13	3.32
Machinery . . . . .	0.36	0.10	0.31	0.15	0.36	0.10
General expenses . . . . .	0.45	0.80	0.51	0.70	0.60	0.71
<i>Total . . . . .</i>	<b>14.47</b>	<b>28.00</b>	<b>12.21</b>	<b>29.41</b>	<b>10.77</b>	<b>28.25</b>
Stacking . . . . .	2.35	2.39	2.46	3.28	2.24	2.52
Stack-threshing (4) . . . . .	2.42	1.02	1.20	1.17	1.46	0.69

Supplementary Data	Northfield	Marshall	Halstad
Yield per acre (bu.) . . . . .	15.64	13.22	16.04
Seed per acre (bu.) . . . . .	1.68	1.30	1.24
Twine per acre (lbs.) . . . . .	2.23	2.70	1.93

(1) Data based on 388 acres of wheat at Northfield; 2900 at Marshall, 8857 at Halstad.

(2) The seed-bed was harrowed 2.5 times at Northfield; 1.2 times at Marshall and 1.7 times at Halstad.

(3) The seed-bed was disked 1.4 times at Northfield; 1.1 times at Marshall and 1.3 times at Halstad.

(4) 219 acres at Northfield; 1860 acres at Marshall; and 2230 acres at Halstad.

If the total percentage of labour devoted to productive work be considered, 73.6 % will be found under the conditions of mixed farming, 69.6 % in the Marshall group and 67.5 % in the Halstad group, as against 58.4 on the grain farm. Extremely well organised and highly diversified farms may devote as much as 80 % of their total labour on productive enterprises.

Most of the farms in Minnesota come into one of these 4 groups; the predominance of certain factors tends to give advantage now to one, now to the other. The data given, if properly controlled, may serve as a basis for any kind of labour on Minnesota farms.

LABOUR REQUIRED FOR VARIOUS CROPS. — In order to supply exact data on the requirements of various crops with regard to man and animal labour, the averages, taken over several years, for each crop are given. The figures refer to the following crops: — spring wheat, corn, oats, barley, rye, flax, potatoes, mangels, hay, timothy seed, clover seed, millet and hemp. Tables VII and VIII summarise the figures bearing on the total number of working hours per acre of men and horses required by each crop in the 4 farm groups, both individually and as a general average, as well as their monthly distribution throughout the year for the Northfield

TABLE VII. — *Average annual hours of labour per acre required in producing field crops (1902-1911).*

Crop	Northfield Rice County		Marshall Lyon County		Halstad Norman County		Glyndon Clay County		Average of all farms	
	Hours per acre		Hours per acre		Hours per acre		Hours per acre		Hours per acre	
	Man	Horse	Man	Horse	Man	Horse	Man	Horse	Man	Horse
Wheat, (shock-threshed) . . . . .	14.5	28.0	12.2	29.4	10.8	28.2	—	—	12.3	29.9
Oats (shock-threshed) . . . . .	14.7	28.2	12.2	30.0	11.7	29.6	—	—	13.5	28.9
Barley (shock-threshed) . . . . .	14.8	27.9	13.3	31.4	11.9	29.5	—	—	12.8	29.9
Autumn rye (shock-threshed) . .	—	—	10.2	27.0	10.4	27.5	—	—	10.3	27.2
Flax (stack-threshed) . . . . .	15.0	31.0	15.6	40.2	12.9	32.6	—	—	13.7	33.8
Corn (husked) . . . . .	30.1	53.6	22.6	51.6	30.9	57.6	—	—	26.2	54.2
Fodder corn (cut, shocked and stacked) . . . . .	33.7	54.1	25.0	51.0	33.1	52.8	—	—	30.4	52.6
Ensilage . . . . .	33.7	56.0	—	—	31.5	63.5	—	—	32.6	59.8
Potatoes (machine production) . .	—	—	—	—	—	—	44.4	75.0	44.4	75.0
Mangels . . . . .	—	—	—	—	—	—	180.7	99.3	180.7	99.3
Hay, timothy and clover, 1st. crop	12.7	11.8	11.0	13.4	12.6	13.8	—	—	12.3	13.0
Hay, timothy and clover, 2 cuttings	21.3	20.3	15.6	23.0	—	—	—	—	20.7	21.5
Hay, wild . . . . .	9.1	10.0	11.2	13.5	13.5	20.7	—	—	12.2	16.9
Timothy, cut for seed . . . . .	—	—	6.0	8.5	4.4	6.1	—	—	5.1	7.1
Clover, cut for seed . . . . .	10.1	11.3	8.1	13.6	—	—	—	—	9.2	12.3
Hay, millet. . . . .	18.5	36.3	16.9	39.1	17.3	39.5	—	—	17.7	39.1
Hemp . . . . .	14.3	27.4	—	—	—	—	—	—	14.3	27.4

and Halstad farms. Table VI gives details concerning the cultivation of spring wheat in the 3 groups, in order to illustrate the analytical scope of the facts collected.

The Northfield group of farms yielded a bushel of wheat with 56  $\frac{1}{2}$  minutes of human labour and 101  $\frac{1}{2}$  minutes of horse labour, not including the labour of threshing. When separators of large capacity are used, 7  $\frac{1}{2}$  minutes of human labour are required to thresh a bushel of wheat. If the separator be smaller the time may be increased to 10 minutes per bushel, while with machines of exceptionally large capacity, it may be reduced to 5 minutes. Stack threshing with machines of average capacity requires 3  $\frac{1}{2}$  to 4 minutes of human labour per bushel. If Minnesota farms are to compete successfully on the international wheat markets, they must increase their unit of production. By good systems of production the labour cost of a bushel of wheat may be reduced from by 25 to 40 %, thus, although more labour per acre is employed, the production unit may be increased from 50 to 100 % by crop rotation and fertilising. The Halstad farms show the extent to which a man's labour may be reduced by the use of machines drawn by 4 horses, or even more, per man; by these means there is an approximate reduction of 4 hour's human labour per acre. Further increase in the productivity of labour must be obtained either by additional labour, or by increased fertility of the soil.

Table VII, which shows the total average hours of labour of men and horses required by the various crops, proves that, for small grains, there is a fairly constant ratio of horse labour to man labour. This ratio is approximately 2.4 : 1 in the small grains, 1.8 : 1 in the cultivated corn crop and 1 : 1 in the hay crop.

RELATION BETWEEN COST OF LABOUR AND TOTAL COST OF CROP PRODUCTION. — The study of the labour cost and production cost has shown that, in the Northfield group the labour cost of producing wheat is \$ 4.82 per acre, or 36 % of the total cost, and, in the Halstad group

TABLE VIII. — Monthly average labour requirements per acre of crops on the Northfield and Halslad farms.

Crop	March		April		May		June		July		August		September		October		November		Total	
	Hours		Hours		Hours		Hours		Hours		Hours		Hours		Hours		Hours		Hours	
	Man	Horse	Man	Horse	Man	Horse	Man	Horse	Man	Horse	Man	Horse	Man	Horse	Man	Horse	Man	Horse	Man	Horse
<b>Northfield</b>																				
Wheat . . . . .	2.0	5.0	1.5	2.1	—	—	—	—	2.0	3.2	2.2	2.2	2.3	4.1	4.0	10.8	—	—	14.0	27.4
Oats . . . . .	0.2	—	1.9	5.4	—	—	—	—	2.2	3.2	1.2	1.1	2.3	4.1	6.0	13.7	—	—	13.8	27.4
Barley . . . . .	0.5	—	1.4	4.4	—	—	—	—	2.1	3.6	3.1	3.2	2.3	4.1	4.9	12.1	—	—	14.3	27.4
Flax . . . . .	—	—	0.4	—	4.0	10.2	—	—	—	—	4.4	7.3	2.2	3.7	3.9	19.7	—	—	14.9	30.9
Field-corn, cut .	0.6	—	—	—	3.5	10.5	8.6	12.9	—	—	—	—	6.5	9.0	3.9	10.1	14.9	19.4	38.0	61.9
Corn fodder . .	—	—	—	—	4.6	15.5	5.1	9.0	—	—	—	—	10.5	11.2	3.9	10.1	8.3	9.4	32.4	55.2
Corn silage . . .	—	—	—	—	4.7	15.7	5.2	9.1	—	—	—	—	19.4	24.3	4.0	10.3	—	—	23.3	56.4
Hay, 1st cutting	—	—	—	—	—	—	—	—	12.7	11.7	—	—	—	—	—	—	—	—	12.7	11.7
Hay, 2nd cutting	—	—	—	—	—	—	—	—	—	—	8.4	8.5	—	—	—	—	—	—	8.4	8.5
Wild hay . . . .	—	—	—	—	—	—	—	—	9.0	10.4	—	—	—	—	—	—	—	—	9.0	10.4
Millet . . . . .	—	—	—	—	—	—	4.2	12.0	1.6	3.1	5.6	4.9	2.6	4.	4.9	11.8	—	—	18.9	36.5
<b>Halslad</b>																				
Wheat . . . . .	—	—	2.0	8.9	—	—	—	—	—	—	2.0	3.2	4.5	7.0	2.7	11.5	—	—	11.2	30.6
Oats . . . . .	—	—	2.5	7.8	—	—	—	—	1.9	3.0	2.3	3.1	2.1	2.9	2.7	12.9	—	—	11.5	29.7
Barley . . . . .	0.9	—	—	—	3.2	12.0	—	—	1.8	3.1	—	—	3.5	4.3	2.9	10.5	—	—	12.3	29.9
Rye . . . . .	—	—	—	—	—	—	—	—	2.0	3.1	2.7	6.2	3.0	6.5	2.8	12.3	—	—	10.5	28.1
Flax . . . . .	0.6	—	—	—	2.5	12.7	—	—	—	—	—	—	5.4	7.9	4.3	11.9	—	—	12.8	32.5
Field-corn, cut .	—	—	0.3	—	3.5	12.0	9.3	13.6	—	—	—	—	5.0	6.7	2.7	12.1	11.6	16.4	32.4	60.8
Corn fodder . .	—	—	—	—	3.2	11.2	6.0	8.1	—	—	—	—	19.0	19.5	3.5	13.0	—	—	31.7	51.8
Corn silage . . .	—	—	—	—	3.0	10.1	2.8	5.4	—	—	—	—	22.4	33.1	3.5	15.1	—	—	31.7	63.7
Hay, 1st cutting	—	—	—	—	—	—	—	—	12.6	3.8	—	—	—	—	—	—	—	—	12.6	13.8
Wild hay . . . .	—	—	—	—	—	—	—	—	12.8	20.8	—	—	—	—	—	—	—	—	12.8	20.8
Millet . . . . .	—	—	—	—	4.4	16.5	—	—	—	—	19.6	10.5	1.1	1.9	2.8	11.2	—	—	17.9	40.1



\$ 4.49 per acre, or 43 % of the total. In this last group the higher cost of labour is due to lower charges for land rent, machinery, etc. The average for the 3 groups of farms studied are 49.8 % of total cost for fodder-corn production, 54.5 % for ear-corn, 50.9 % for hay, 36.4 % for flax, 31.3 % for wheat, 36.5 % for oats, 31.1 % for barley and 30.2 % for rye.

The differences between the labour required under mixed farming conditions and single-cropping conditions are surprisingly small. These differences are determined largely by the size of machinery and the number of horses used per man. The size of the field, so long as it does not prevent the use of equal sized machinery, has a very slight influence. A farm of 240 acres, or even less, if the fields are properly arranged, may grow a crop with no more labour per acre than is required on a farm of from 400 to 600 acres with fields of larger size. The fact that, in the Marshall group, corn requires approximately 7 hours' less labour per acre, is due rather to the greater efficiency of the workers in the husking rather than to any difference in the size of fields and of machinery used. This seems to show that the change of an agricultural system in a given district, from the production of a single group of crops on large farms to mixed farming on a scale less extensive, yet large enough to allow the use of a team of 4 or 5 horses, may be brought about without necessitating an increase in the labour required for crop production. The principal problem to be solved is the distribution of work during the year so that the different operations to be carried out during the same period shall not clash, for, should this happen, the whole organization of the farm, and, consequently, that of the desired change, is compromised. In the north-western states, for example, the cutting of the first crop of alfalfa usually coincides with the cultivation of the corn. In this case, either additional labour must be employed, or else the average under alfalfa must be reduced so as not to interfere with the cultivation of the corn crops. Similarly, the harvesting of corn for silage falls at the same time as the threshing of the grain crops, etc.

The distribution of work for the principal crops throughout the year (Table VIII) gives valuable information on this point. The figures given are the averages for 8 years, and in most cases are exempt from the special influence of the seasons in each of these years.

A detailed study of the number of hours required for marketing the products and for threshing terminate the paper.

### 763 - Labour Requirements of Dairy Farms as Influenced by Milking Machines. —

HUMPHREY, H. N., in *U. S. Department of Agriculture, Bulletin No. 423* (Professional Paper by the Office of Farm Management), pp. 1-18. Washington, November 25, 1916.

This bulletin gives the results of a series of studies on the organization of dairy farms, undertaken to determine the influence of the introduction of milking machines on the amount and distribution of labour on such farms.

The data were obtained from 109 New York dairy farms, 56 of which were using mechanical milkers, and from 160 farms in Ohio, Michigan and Illinois, 100 of which were using milking machines. Whereas, on the New York farms, dairy produce represented 90 % of the total business, on the other farms labour was largely devoted to general farming.

The principal facts obtained are as follows:

The time gained by mechanical milking increases with the number of dairy cows in the herd. In herds of 15 cows or less, the average time required to milk one cow by hand is more than 7 minutes, and the corresponding time by machine less than 5 minutes. In herds of more than 50 cows, the average time for hand-milking is a little less than 7 minutes, for machine milking, 4.15 minutes. In herds of more than 50 cows one man can milk 28 cows by machine, whereas, by hand he can only milk 17.

The cost of hand milking changes but little with an increase in the herd, whereas that of machine milking decreases rapidly.

The average annual cost of milking a herd of 15 cows by hand is \$10.91 per cow; in herds of 50 cows this cost is \$10.45. In the first case mechanical milking costs \$11.77, in the second, \$7.34.

This does not mean that, in herds of less than 15 cows, mechanical milking is more expensive than hand milking. On 32 farms with less than 15 cows, machine milking allowed an annual economy of \$2.63 per cow as the result of labour saved.

The appended table gives a summary of the labour employed on farms milking by hand and those milking by machine in the states of New York, Michigan, Ohio and Illinois. The total area and the labour devoted annually to crops (i. e. not including the meadows) are taken into consideration).

*Farms without milking machines.*

State	Number of farms	Average size (acres)	Number of men employed per farm per acre	Acres of crops raised per farm	Acres of crops per man	Number of dairy cows per farm	Number of dairy cows per man
New York, . . . . .	53	191.4	2.16	73.8	34.2	30.8	14.3
Michigan, Ohio, Illinois	60	146.7	2.14	90.75	42.4	20.5	9.6

*Farms with milking machines.*

New York, . . . . .	56	213.9	2.12	71.4	33.7	34.9	16.5
Michigan, Ohio, Illinois	100	166.4	2.22	98.3	44.3	23.7	10.7

The Michigan, Ohio and Illinois farms have a larger proportion of acreage under crops than many of the New York farms. They raise more crops per man employed and keep fewer dairy cows. From the point of view of the labour employed they are better organized than the New York dairy farms. Moreover, owing to the lack of good milkers and the high wages demanded, mechanical milking is of great importance on these farms.

764 - **The Theory of Correlation as Applied to Farm Survey Data on Fattening Baby Beef.** — TOLLEY, H. R., in *U. S. Dep. of Agric., Bulletin No. 504*, Professional Paper; Office of Farm Management, pp. 1-14. Washington, May 23, 1917.

This paper sets forth the results of an experiment in applying the theory of correlation, hitherto used chiefly in the analysis of biological, sociological, psychological, and meteorological statistics, to the study of some of the data of the office of Farm Management (1).

The material for the investigation was obtained from 67 records, taken, during the years 1914 and 1915, from farmers of the cornbelt, who were fattening baby beef for market (2). The factors considered were:

(1) Cfr. *B. No. 1316*, December 1916.

(2) Cfr. Report III, Office of the Secretary 1916 and *B. June 1917*, No. 583 (Ed.).



The profit or loss per head, the weight, value per hundredweight, value of feed consumed per head, cost at weaning time and date of sale. Coefficients of correlation were computed for every pair of these factors and used as a measure of the relationship existing between them.

This application of the theory of correlation to the data on fattening baby beef animals showed :

1) That for the herds considered, the cost of producing the calves and carrying them until weaning time was by far the most important factor in determining the profit ;

2) That there was no connection between the cost at weaning time and any of the other factors, for the calves which were produced cheaply were seemingly just as good feeders and brought just as good a price per pound as the more expensive ones ;

3) That the weight at which the calves were sold and the date of sale had very little effect on the profit, except for the fact that in the two years of the records the price was higher in the latter part of the summer, at the time when the heavier calves were put on the market ;

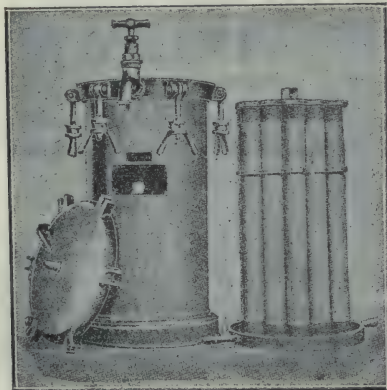
4) That the calves which consumed the heaviest ration sold at higher prices than the others, but did not return a correspondingly greater profit, as the advanced price scarcely offset the extra value of feed consumed.

## AGRICULTURAL INDUSTRIES.

INDUSTRIES  
DEPENDING  
ON PLANT  
PRODUCTS

765 - A New Apparatus for Pasteurising Wine in the Cold. — MERZ, F. I., in *Allgemeine Wein-Zeitung*, No. 21, p. 165, 1 fig. Vienna, May 24, 1917.

There are no filters which can remove the bacteria and moulds from wine, the reason being that the filter-pores are too large. Thus, if it is required to remove the microflora from wine, pasteurisation must be used, which results in impaired quality of the wine.



A New Apparatus for Pasteurising Wine in the Cold.

The writer has invented a new filter which retains the organisms and thus permits of pasteurising without heating : it consists of a fairly large number of porcelain cells ("Filterzellen" or "Filterkerzen") with pores so fine that the bacteria are retained. The quantity of wine filtered is not very large, being 17.6 to 132 gallons per day for a filter consisting of 6 to 30 cells ; the daily yield of a cell is thus 3.63 gallons, on an average. To obtain satisfactory results, the wine should not be turbid, should not contain many impurities and should contain carbonic acid gas at a pressure of from 0.5 to 1.5 atmospheres.



The process is, therefore, most suitable for sparkling wines and those of fine quality. It does not give a sufficient daily yield, but the writer hopes to modify the apparatus so as to obtain a higher yield. In any case, the apparatus marks an advance in wine-making.

766 - **The Use of Metabisulphite of Potassium and Sodium in Wine-making.** —

CARLES, P. in the *Bulletin de l'Association des chimistes de sucrerie et de distillerie de France et des Colonies*, Vol. XXXV, Nos. 4-6, pp. 143-145. Paris, October-November-December, 1916.

As the greater part of the potassium salts come from German mines they have had to be replaced, in the allied countries, by sodium salts, and, in wine-making, potassium metabisulphite is replaced by sodium metabisulphite. Although pure sodium metabisulphite contains 67.2 % of sulphur dioxide, it is not so satisfactory as potassium metabisulphite which only contains 57.6 %.

Sodium metabisulphite is sold in powdered or compressed form, since it does not crystallise; it therefore presents a larger surface to the air than does potassium metabisulphite. This reduces the strength and causes it to lose its acid relatively quickly. Moreover, in the powdered form, it is more subject to adulteration.

Wine, as a rule, contains sufficient tartaric acid to precipitate the potassium, but when sodium is used, soluble acid tartrate of soda is formed, leaving an excess in the ash.

Sodium metabisulphite is rarely free from iron. When sodium metabisulphite containing iron is poured into white wine, the wine, after a few months, turns dirty grey, gradually changing to black. This is due to the formation of ferric tannate by the action of the iron on the tannic matter in the wine.

Sodium metabisulphite keeps better bottled as a saturated solution than as powder. The commercial solution is colourless, with a distinct burnt sulphur smell. According to whether it is prepared in winter or in summer its density is 1.300 or 1.350, or 35° Baumé, values corresponding to 320 gr. of sulphur dioxide per litre.

To avoid contaminating the flavour by the use of sodium metabisulphite it is necessary to know : 1) the amount of sulphur dioxide it contains ; 2) the amount of iron it contains.

The first test, made with iodine, should be done by an expert. The second test may be easily carried out as follows : — About 20 gr. of bisulphite solution are poured into a porcelain dish and as much nitric acid, gradually added, as is required to free the sulphur dioxide. This is evaporated and heated till it begins to melt. If the mixture turns a more or less brown ochre colour iron is present. As control the mixture should be left to cool, dissolved in warm dilute hydrochloric acid and saturated with an excess of ammonia. The iron separates out as loose flakes of oxide and may be estimated by the use of an ordinary filter.

The same method may be used for the powder, 10 gr. of which should be moistened with about an equal quantity of water.

767 - **The Use of Apples in Grain Distilleries.** — LINDET, in *Comptes rendus des Séances de l'Académie d'Agriculture de France*, Vol. 3, No. 26, pp. 710-712. Paris, July 11, 1917.

Owing to the promising apple crop this year in France, attention is being directed to their utilisation for distilling.

In 1915 apples had been distilled with beets (1) (the mixture containing 10 to 20 % of apples), but the results were unsatisfactory. The apples cannot be cut with the same shaped knife as the beets; the temperature required by the beets is too high for the apples, which go to pulp, thus preventing the circulation of the juice, the apples do not contain sufficient nourishment for the yeasts; the mixture of apple and beet juices ferments badly because the yeast required by one predominates over that required by the other.

The author points out that the slowness of the fermentation of apples is due to the lack of nutritive substances, and that these substances (ammonium sulphate, phosphate, etc.) are most expensive and difficult to obtain. It is, therefore, most advisable to use the apples as juice, as grated pulp, or even as boiled pulp, in the presence of grain treated with acid or malt, as the grain contains nutritive substances in excess of those required by the yeast. It is possible to add to a given weight of maize 3 and 4, or even more times its weight of apples.

768 - **Home-Made Beet Syrup as a Substitute for Sugar.** — TOWNSEND, D. C. and GORE, H. C., in *United States Department of Agriculture, Farmers' Bulletin* 823, pp. 13, fig. 10. Washington, May 1917.

The authors describe a method for the manufacture of beet sugar (Patent No. 1 555 806 of October 5th., 1915).

The beets are carefully cleaned by soaking for a few minutes and then washing with a brush. A barrel is placed upright and the beets finely sliced with a sharp knife on the barrel, so that the slices fall inside. Boiling water is then immediately poured over the beets so that they are well covered. The barrel is then covered, wrapped in a cloth folded many times, and left for an hour; from time to time it is shaken without being uncovered. The liquid is then filtered through a cloth or rum out through a tap in the cask. The filtered liquid is then evaporated over an open fire till it becomes syrupy. Thirty-five litres of beet give 70 litres of slices which are covered with 38 litres of boiling water. The slices are not crushed after maceration; as they still contain a little sugar they make an excellent food for poultry, pigs, etc. The scum which rises during heating must be carefully removed, by this means the syrup loses the disagreeable taste of the beets. The syrup, while still hot, is put into boxes or bottles, which are carefully closed up so as to prevent the formation of moulds.

769 - **Method of Bread-Making with Previously Soaked Grain.** — LINDET, in *Comptes Rendus de l'Académie d'Agriculture de France*, No. 18, pp. 508-513. Paris, May 16, 1917.

The French Department of Agriculture nominated a special commission to study the method of bread-making tested at Bergamo (Italy) (1). The

(1) See B., July 1917, No. 668.

(1) " 1916, No. 679.

(Ed.)

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commission used good Australian wheat and medium La Plata wheat. Half of each wheat was ground, all the products mixed and worked in the usual way. The other two halves were heated by the Italian method, and all the bread cooked in the same oven. The bread made with soaked wheat and that made with ground wheat differed very slightly in appearance. As regards taste the results were as follows:

No. 1) Australian ground wheat: slightly unpleasant.

No. 2) Plata ground wheat: marked taste of bran making it slightly sour.

No. 3) Australian soaked wheat: sour.

No. 4) Plata soaked wheat: unpleasant.

Whole-meal bread made with ground grain is superior to whole-meal bread with soaked grain. This latter method can only be used with well-cleaned and well-washed wheat.

770 - **Utilisation of Rotten Potatoes in the Manufacture of Starch.** — I. Observations de M. DUCOMET. — II. Remarques de M. GIRARD A. Ch. in *Comptes rendus des Séances de l'Académie d'Agriculture de France*, Vol. 3, No. 26, pp. 716-719. Paris, July 11, 1917.

I. — Spoiled potatoes are in general use for starch-making when decomposition has not gone very far, but when actually rotten they are thrown on the manure heap. M. SCHRIBAU, when reading to the Academy a short paper by M. DUCOMET, remarked that this worker's observations have shown that even when tubers are in a deliquescent state, the starch is still undecomposed; liquefaction of the starch only takes place very late. It is therefore advisable to collect all potatoes attacked by damp rot whatever the initial cause of this may be (frost, mildew or other organisms), and to extract the starch. This latter, when properly sterilised, is suitable for consumption by man as well as by animals.

It is interesting to note that the period of treatment of the damaged potatoes can be considerable prolonged by keeping them water, this latter then being periodically changed.

II. — M. A. CH. GERARD remarks that about 75 % of the nitrogen and 90 % of the potash contained in the tubers is carried off in the water in which they are washed. These substances are worth utilising; this though difficult commercially should be easy on the farm. The most simple process consists in absorbing the residuary water by a heap of manure, compost or even by earth. A better process consists in bringing the water to the boiling point. The half of the nitrogen which is in the albuminoid state would be coagulated and the nitrogenous coagulum could be used almost pure for feeding stock; the other half of the nitrogen as amides and the mineral elements remaining in the water would go to the manure or to the soil.

771 - **Some Observations upon the Relation of Humidity to the Ripening and Storage of Fruits.** — SHAMEL, A. D., in *The Monthly Bulletin of the California State Commission of Horticulture*, Vol. VI, No. 2, pp. 39-41. Sacramento, California, February 1917.

These experiments and observations of the effect of different conditions of relative humidity upon the ripening and curing of lemons hold in storage,



have been conducted in the National Orange Company's lemon storage and packing house at Corona California. In this building there are twenty rooms, each containing about 8000 cubic feet of space, in which a reasonably effective control of the conditions of temperature and relative humidity has been secured by means of ventilation, steam heat and special humidifiers.

In an experimental curing of a roomful of lemons, with the room maintained for four weeks at about 90° F. and about 90 per cent. relative humidity, more than 90 per cent. of the cut stems of the fruits calloused over perfectly in the same manner as is the case with cuttings under favourable conditions. This was the first time when any such large proportion of the fruits developed this callous.

In further experiments it was discovered that the development of the calloused condition depended largely on the maintenance of a uniform condition of relative humidity and that the callous developed more rapidly under a high temperature of about 95° F., than under a low temperature of about 50° F. It was demonstrated that under fluctuating conditions of relative humidity varying from about 50 per cent. to about 95 per cent. daily, due to ventilation or other causes, very little development of the callous was observed.

With a condition of uniformly high relative humidity (about 90 per cent.), comparatively little loss of weight in the cured fruits was observed, irrespective of the temperature during storage, and the lemons developed a smoother texture, lighter colour, and better commercial appearance than those where a condition of low relative humidity (70 per cent.) was maintained, or where the condition of relative humidity fluctuated over a considerable range during the periods of storage.

Hard ripe Bartlett pears, placed under similar conditions, and held for 30 days at temperatures ranging from 85 to 100° F., and a relative humidity ranging from 85 per cent. to 96 per cent. remained hard and retained their green colour until the end of the experiment without ripening or deteriorating. The pears kept in a family storage room, where no attempt was made to control either the conditions of temperature or relative humidity turned in a week in colour from green to a golden-yellow, became soft and reached a prime eating condition. The writer believes that the condition of high relative humidity was a controlling factor in retarding the ripening of the pears.

The extraordinary condition of calloused stems, and the perfect preservation of buttons (the calyx) of lemons and the superior commercial quality of the fruit, in the case of lemons stored under uniform conditions of high relative humidity, tend to emphasize the importance of the factor of relative humidity to the storage and ripening of fruits.

Further experiments on the subject are now in progress.

772 - **Temperature Relations of Apple-Rot Fungi.** — BROOKS, C. and COOLEY, J. S., in the *Journal of Agricultural Research*, Vol. VIII, No. 4, pp. 139-163, figs. 1-25, tables I-III. Washington, D. C., January, 1917.

Rot in stored apples is due to the action of many micro-organisms which, after entering the fruit, live first as parasites, only becoming saprophytes

when the increased growth of their mycelium permits them to find, in the decomposed tissues, the substances necessary to their development. These microorganisms are: — *Alternaria* sp., *Botrytis cinerea*, *Cephalothecium roseum*, *Fusarium radiculicola*, *Glomerella cingulata*, *Neofabraea malicorticis*, *Penicillium expansum*, *Sclerotinia cinerea*, *Sphaeropsis malorum* and *Volutella fructi*.

One of the best methods of storing fruit is to keep it at a temperature below that required for the development of the micro-organisms. This temperature varies with the fungus, the nature of the medium, the variety and ripeness of the fruit.

This paper deals with rot of stored apples from data obtained by experiments carried out under special low temperature conditions.

The most important results are as follows:

1) All the micro-organisms inoculated into the pulp of healthy fruit grew normally at a temperature of 0° C, except *Fusarium* and *Glomerella*, the former making no growth at 15° and the latter none at 10° C.

2) The optimum temperature is about 25° C., except for *Neofabraea malicorticis* and *Fusarium*, for which it is respectively 20° and 30°; naturally the growth of the fungus is most rapid in temperatures near this optimum. *Sclerotinia cinerea* produces rot at 5° in one week, whereas at 0° two weeks are necessary. Above the optimum, growth drops off rapidly.

3) The effects of low temperature are much more evident during the first stages of the incubation of the fungus than during the saprophytic stage.

*Penicillium expansum*, when inoculated into rather immature apples which have been put into store a long time after being picked, continues to grow at 0°, whereas, at the same temperature, similarly infected, fruit which has been put in store immediately after being picked remains perfectly healthy. This behaviour applies to all the micro-organisms under consideration, and shows the importance of immediate storage.

4) The temperature limit also varies with the ripeness of the fruit, decreasing as the apples ripen. Thus at 0°, in ripe apples of the York Imperial and Ben Davis variety, *Penicillium expansum* caused rot in 4 weeks, on Yellow Newtown and Winesap that were rather greener, in 8 weeks, but on unripe York Imperial and Arkansas it produced no rot at this temperature even after 18 weeks.

5) The maximum and minimum temperatures may be modified by the media on which the fungi are grown. When inoculated into the Yellow Newton and Winesap varieties, *Glomerella cingulata* does not develop at 10°, nor *Fusarium radiculicola* at 15°, but both these microorganisms grow well on corn-meal agar at 5°.

773 - Refrigerating Establishments in Italy. — MINISTERO DELL'INTERNO DIREZIONE GENERALE DELLA SANITÀ PUBBLICA. *Notizie statistiche sui frigoriferi esistenti in Italia al 30 Novembre 1915 per la conservazione delle carni fresche o congelate e degli altri prodotti alime, tati di origine animale*, pp. 105, tables. Rome, 1916.

In view of the great economical and hygienic importance of the cold storage of animal products, particularly of meat, the Italian Department of



Public Health took a census of the refrigerating establishments in the country.

In addition to detailed information, there is a table enumerating all the establishments in each Italian district, province and town up to the end of 1915. This census shows a very rapid growth of the industry during the last ten years.

The greatest number of refrigerating establishments are to be found in northern Italy, particularly in Lombardy and Piedmont. Throughout the kingdom there are 250 establishments, situated in 150 towns in 46 out of 69 provinces. The provinces of Turin and Milan alone include  $\frac{1}{2}$  of all these establishments. Central Italy has progressed during the last years, but there are still certain provinces devoid of any installation for preserving foodstuffs. The southern districts, Sardinia and Sicily, are in greatest need of refrigerating facilities, in spite of the fact that their warm climate should give an impetus to the development of cold storage.

The greatest number of installations is in the following 9 provinces: Turin (24), Milan (23), Como (20), Bergamo (10), Novara (11), Cuneo (12), Padua (10), Mantua (10), Udine (4). These 9 provinces possess  $\frac{2}{3}$  of the important refrigerating establishments of Italy, and the greatest number in proportion to their population and area.

As regards capacity, the largest of these establishments (chiefly for frozen meat) are at Genoa, Milan, Naples, Venice, Rome, Bologna and Parma. The most important one is at Genoa, and has a total capacity of 30 000 cubic metres,  $\frac{2}{3}$  of which are reserved for meat, and  $\frac{1}{3}$  for eggs, poultry, etc.

Milan has an establishment of about 20 000 cubic metres, used for frozen and chilled meat, lard, poultry, game, butter, eggs dried and salted fish, etc. At the present time about 40 towns have refrigerating establishments attached to the municipal abattoirs.



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## PLANT DISEASES

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### GENERAL INFORMATION.

774 - Decree of the Italian Minister of Agriculture Regulating the Issue of Certificates of Immunity to Growers and Sellers of Plants or Portions of Plants. — *Gazzetta ufficiale del Regno d'Italia*, Year 1917, No. 180 p. 3443. Rome, July 31, 1917.

Under date of May 31, 1917, the Italian Minister of Agriculture, in view of the necessity for regulating the issue of certificates of immunity to producers and sellers of plants or of portions of plants, has issued the following decree which entered into vigour on August 1.

Art. 1. — Certificates of immunity (mention of which is made in art. 8, No. 4 of the regulation of March 12, 1916, No. 723 (1) are issued to growers of plants subject to inspection upon payment of a fixed sum proportional to the extent of the area to be inspected.

The sum fixed is 5 lire in cases where the total area to be inspected does not exceed 1 hectare (2.5 acres), and in other cases 5 lire for the first hectare and 3 lire for each remaining hectare or fraction of a hectare.

Art. 2. — The money is to be paid to the Registry Office against a receipt which should be presented by the grower to the Director of the Regional Observatory of Phytopathology who notes in a special register the date of payment, the number of the receipt and the name of the official to whom payment was made.

In no case shall a certificate be issued unless the above-mentioned fee has been paid.

LEGISLATIVE  
AND ADMINISTRATIVE  
MEASURES  
FOR THE  
PROTECTION  
OF CROPS

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(1) See *B.* August 1913, No. 995, on mesures for the prevention and control of plant diseases. (Ed.).

## DISEASES NOT DUE TO PARASITES OR OF UNKNOWN ORIGIN.

775 - **Factors Determining the Occurrence of "Silver-Leaf" on Trees.** — PETRI L., in *Annali del R. Istituto sup. forestale nazionale*, Vol. II, 11 pp., 2 figs, 1 plate. Florence, 1917.

Both in Europe and America a large number of trees are found the leaves of which have a leaded or silvered appearance. The chief anatomical fact underlying this phenomenon, which also explains the metallic sheen on these leaves, is the detachment of the epidermal layer from the palisade tissue, giving rise to an intercellular space. The air penetrates into this space and reflects back the whole of the light falling upon the leaves. An almost invariably observed, but unimportant fact, in these cases is that the epidermal cells are slightly hypertrophied.

This disease, which was initially considered non-parasitic, has since been classed among those of a parasitic nature — apparently definitely — the organism concerned being the basidiomycete *Stereum purpureum* (1)

The writer's observations, however, show that in some cases leaves with a metallic sheen may occur on orchard or forest trees without concomitant infection of the branches by *St. purpureum* or other microorganisms.

A 3 year-old peach tree grown from seed and pollarded in April 1916 when in full growth, quickly produced a number of stout shoots about 20 cms. from the point where the crown had been removed. These, in turn, produced numerous lateral branches which usually bore leaves whose upper surface showed a white metallic sheen. The silvered leaves appeared by preference upon the lowest branches, their orientation being indefinite. The branches grown nearest to the point where the tree had been cut bore normal leaves. The metallic appearance persisted till the leaves fell at the end of the season.

Observations have shown that the metallic sheen is due to an abnormal accumulation of calcium oxalate crystals in the epidermic of the leaves. The total absence of foreign organisms in the leaves, branches and roots excludes the idea of the abnormal accumulation of calcium oxalate being due to the action of parasites and confirms the supposition that it is an indirect effect of the removal of the crown and the conditions of nutrition of the plant.

A third factor capable of determining the metallic sheen on the leaves is the more or less complete detachment of the cuticle of the upper epidermis.

The writer has recently studied this phenomenon on the leaves of *Viburnum Tinus*, which frequently show a leadish colour over a portion or the whole of their surface. A very thin layer of air is interposed between the cuticle and the pecto-fibrous lamella lying below the external wall of the cells of the epidermis.

(1) See on this subject *B. Jan.* 1912, No. 249 and *B. April* 1913, No. 334

(Ed.).

In the leaves of *Euonymus europaeus* the white metallic sheen is caused by the detachment of the cutinised layer from the pecto-fibrous lamella and by the disappearance of the chlorophyll from the outermost layer of palisade tissue.

With regard to the causes underlying such changes, the phenomenon is, in final analysis, of the same nature as that presented by the typical, parasitic form of the disease; that is to say, it is due to a process of hydrolysis of the pectic substances of the walls of the epidermal cells. It is doubtless due to the action of a pectinase, the formation and abnormal secretion of which depend upon external influences.

### DISEASES DUE TO FUNGI, BACTERIA AND OTHER LOWER PLANTS.

776 - Influence of Temperature on the Development of Fungi causing Rot in Stored Potatoes. — See No. 772 of this *Bulletin*.

GENERAL.

777 - On the Specific Susceptibility of Barley to Leaf Stripe Disease (*Helminthosporium gramineum*). — KIESSLING, in *Zeitschrift für Pflanzenzüchtung*, Vol. 5, Part 1, pp. 31-40. Berlin, March 1917.

DISEASES  
OF VARIOUS  
CROPS

The writer has observed that different varieties of barley are diversely affected by this disease.

At the Experimental Station of Weihenstephan he has examined 29 varieties, the researches lasting over a period of 3 years. The practical conclusions are as follows:

1) The breeder should devote all his attention to studying the susceptibility of his varieties of barley to "leaf-stripe". In order to obtain accurate results, he should not only separate the strains in the nursery, but later on as well, after one or several generations, examine them early and note the plants attacked. In this connection it is not sufficient to search in a single spot only, because, owing to influences inherent in the constitution of the soil, the disease may occur under quite a different aspect in different parts of the same area. Further experiments must be continued for several years in succession because experience has shown that climate — especially high temperatures during and after germination — may modify the appearance of the disease. Strains which, on different plots and for several years, show themselves to be fairly susceptible to the disease, should be excluded.

2) By crossing pure strains with strains of proved resistance, an attempt should be made to obtain varieties resistant to leaf stripe.

3) As the spread of the disease depends primarily upon the degree of infection of the locality where the seed has been produced, and as the possibility of infection varies markedly according to the nature of soil and climate, sowing a barley derived from localities and soils frequently or strongly infected by leaf stripe should be avoided.

4) In addition to infection by germs from the soil and by fungi adher-



ing to the grain, infection of the flower by *Helminthosporium gramineum* Rabenh. also occurs; a good method of reducing the danger of infection is to remove infected plants from the nurseries or breeding plots at an early date in the same way as with smut.

5) In order to prevent the flower from becoming infected, it is advisable to sort the grain carefully as it is the spikelets from the upper portion of the ear which flower late and give small seed which are most exposed to infection.

6) For direct control of the disease, besides the employment of immune plots, recourse may also be had to immediate treatment of the seed. In the majority of cases it is sufficient to destroy the fungi adhering to the grain by means of the usual methods (copper sulphate, mercury salts, formalin etc.), but, owing to infection of the flower, complete destruction of the pest is impossible. It is necessary in consequence, to combine the heating process (hot water or air, with swelling of the grain) with the chemical process, in this way both kinds of smut may be destroyed. Establishments concerned with the production of seed grain situated in districts suffering from leaf-stripe should only sell their seed to farmers after it has been treated. Later infection of the seed by the soil could be prevented by the employment of copper solution with the addition of lime, according to TUBEUF's formula; with this method a sort of crust is formed at the surface of the grain.

7) The officers whose duty it is to keep the peasants informed as to what varieties to use etc. and to conduct experiments should, in future, direct greater attention to the specific behaviour of barley with regard to leaf-stripe; if possible, they should exclude from the market all varieties which, for a long period and in different localities, have proved to be more susceptible to the disease than the remainder. Further, public cooperative bodies should examine the crop in order to determine definitely whether they are diseased; this inspection should be carried out when the plants are green.

778- *Sclerotinia Matthiolae* n. sp., Parasitic on *Matthiola valesiaca* and other Cruciferae, in Switzerland. — CENDNER A., in *Bulletin de la Société botanique de Genève*, 2nd. Series, Vol. IX, No. 1-3, pp. 21-29, figs. 1-3. Geneva, 1917.

In 1916, some specimens of *Matthiola valesiaca*, cultivated near Genoa, were attacked by a disease in which the inflorescences suddenly withered and the petals changed from their original violet colour to red, as if they had been acted upon by an acid. The plants attacked soon died.

The disease appeared also upon other Crucifers, such as *Aubrieta* (fairly seriously), *Biscutella*, *Erysimum*.

Within the stems of the sick *Matthiola* plants there was found a small black sclerotium.

Microscopical examination and experiments with artificial cultures showed that the withering phenomenon is to be attributed to a species of *Sclerotinia*, described as new to science under the name of *Scl. Matthiolae*, and as closely related to *Scl. libertiana* and *Scl. lanacis*.

779 - *Didymella applanata*, a Sphaeriaceae Parasitic on the Raspberry in Switzerland. — OSTERVALDER, A., in *Schweizerische Obst- und Gartenbau-Zeitung*, No. 12, pp. 175-177, 1 fig. Münsingen, 1917.

The disease of the raspberry, already recorded in Switzerland (1) and easily recognisable by the reddish brown or purple patches which appear on the branches, developed, during 1916, to a very considerable extent.

New observations, confirmed by experiments on artificial infection, have shown that the fungus which penetrates the young stems and causes the patches is the ascomycete *Didymella applanata*.

As the young stems of some cultural varieties of the raspberry ("Harzjuwel", "Baumfoorh's Sämling", etc.) show a waxy whitish investment, the writer recommends increasing the adhesiveness of the Bordeaux mixture by adding a solution of soft soap so that the spraying mixture contains 2 % of this latter and 1 ½ % of copper sulphate.

## WEEDS AND PARASITIC FLOWERING PLANTS.

780 - *Scorzonera laciniata*, a New Weed in Southern Australia. — ANDREW, H. W., in *The Journal of the Department of Agriculture of South Australia*, Vol. XX, No. 7, pp. 557-558, 1 fig. Adelaide, 1917.

A description of the Composite *Scorzonera laciniata* C. (= *Podospermum laciniatum* D. C.) This weed was found in 1916 on neglected farm land at Collinswood, in the Council of Prospect district. Judging by its present distribution it has been established there for several years past; it appears to be confined to this locality.

## INJURIOUS INSECTS AND OTHER LOWER ANIMALS.

781 - New Mites, mostly Economic (Arach., Acar.). — BANKS, N. in *Entomological News*, Vol. 28, No. 5, pp. 193-199, plates XIV-XV. Philadelphia, May, 1917.

GENERALITIES

The following should be noted:

1) *Notophallus viridis* n. sp., found on wheat at Tempe (Arizona) and at Wagoner (Oklahoma);

2) *Tetranychus antillarum* n. sp., on leaves of *Leonotis nepetaefolia* and on *Asclepias curassavica* at Río Piedras (Porto Rico);

3) *Tetranychus decepta* n. g. and n. sp. on barley at Mesa (Arizona);

4) *Tetranychina apicalis* n. g. and n. sp., and on white clover, at St. Bernard (Louisiana);

5) *Stigmaeopsis celarius* n. g. and n. sp., on leaves of *Bambusa Metake* at Oneco (Florida);

6) *Tyroglyphus sacchari* n. sp., on sugar cane, in the island of St. Croix.

7) *Chortoglyphus gracilipes* n. sp., on tobacco infested with *Lasioderma serricorne* (cigarette beetle) at Tampa (Florida).



782 - Relation between Climate and Life-Cycle of the Tussock Moth (*Liparis monacha* = *Lymantria monacha*). — SEDLACZEK, in *Oesterreichische Forst- und Jagdzeitung*, Year 34, No. 44, pp. 259-260. Vienna, 1916.

During the period 1906-1915, the writer has made careful observations on the multiplication of the Tussock moth in relation to the climate. He has discovered that the transformation of this moth from chrysalis into perfect insect takes place at very different periods; sometimes the moths begin to fly during the first half of July and at others during the last days of August, according to locality and climate. Later researches have shown that the majority of these moths only completed their development when the aggregate daily temperature, calculated from the 1st of May, reached 1500° C.

The moth only flies on calm evenings with a temperature of 15° C. or above; never during rain. In Bohemia, however, the total temperature of 1500° C. is sometimes reached as early as the first half of July, sometimes towards the end of August; in the mountains it is reached still later. Evenings without wind or rain are relatively more frequent in Bohemia, during the months of July and August; during September they are rarer and in the mountains at this time such evenings never occur. The earlier, therefore, the necessary sum-temperature is obtained, the greater the time the moth has at its disposal for flying, and vice versa. If, for example, in the mountains this sum-temperature is only reached in September, the insects have no longer many evenings left for flying. As fertilisation of the female takes place chiefly on such evenings, it is obvious the propagation of the insect must suffer in consequence. The writer has observed that after years with 12 evenings favourable to flight, the moth has multiplied to a much greater extent than after years with a smaller number of favourable evenings; this explains why it does not breed to any very great extent in the mountains.

It would be wrong, however, to believe that the appearance of the moth is merely in relationship with the climate; parasites and disease are also concerned.

The writer's conclusions — which agree in the main with those of FEDERBAUER — are as follows:

1) The "tussock moth" requires for its post-embryonic development a sum-temperature of 1500° C. In any given place the moths only appear in great numbers when this total has been reached.

2) The nuptial flights take place on fine, windless evenings, when the temperature is above 15° C. An increase in the numbers of the moths was noticed after years in which there were at least 12 favourable evenings during the flying period.

3) The flying period commences, therefore, when the sum-temperature of 1500° C. has been reached, and ends when no more evenings occur with a temperature of 15° C. In districts where the two epochs are very close together, the appearance of the moths in any great numbers is out of the question. The same thing is true after years when the period between the two epochs has been marked by cool, rainy or stormy weather.



783— **Notes on Coccid-Infesting Chalcidoidea** (1). — WATERSTON, J., in the *Bulletin of Entomological Research*, Vol. VII, Part. 4, pp. 311-325, figs. 1-7. London, May, 1917.

This list includes :

- 1) *Coccidoxenus distinguendus* n. sp. reared from *Lecanium* and *L. subhemisphaericum* Newst. n. sp., both living on the coffee-tree at Aburri. (Gold Coast).
- 2) *Aethognatus afer* Silv., obtained from *Stictococcus diversiseta* Silv., at Aburi.
- 3) *Aeth. afer*, var. *cavilabris* n. var, taken from *Stict. dimorphus*, at Entebbe (Uganda).
- 4) *Eusemion cornigerum* Walk., obtained from *Paraairmairia gracilis* at Camberley (Surrey).
- 5) *Habiolepis apicalis* n. sp., obtained from *Chionaspis minor* at Aburi.
- 6) *Aspidiotiphagus citrinus* Craw., obtained from *Chion. graminis* at Peradeniya (Ceylon) ; from *Aspidiotus camelliae*, at Salisbury (Rhodesia) from *Chion. minor* at Aburi.
- 7) *Eriaporus laticeps* n. sp. taken from a scale insect living on the cocoa-tree at Aburi.

784— ***Rhyssa persuasoria* and *Ephialtes manifestator*, Hymenoptera Useful to Forestry.** — BORDAS L., in *Comptes rendus hebdomadaires des séances de l'Académie des Sciences*, Vol. 164, No. 24 (June 11, 1917), pp. 923-925. Paris, 1917.

Among the Ichneumonidae protecting forest trees (spruce, pine, oak, etc.) against injurious insects, special mention must be made of the genera *Rhyssa* Graven. and *Ephialtes* C., subfamily Pimplinae.

*Rhyssa* particularly attacks the larvae of Siricidae (*Sirex*) and *Ephialtes* those of various Buprestids and Cerambycidae (*Callicium*).

One of the best defenders of coniferous trees is *Rh. persuasoria* which is fairly common among pines, larch, spruce, etc., the female flying along the trunks and branches on the look out for the *Sirex* larvae in the galleries bored in the wood. When ovipositing, the female carefully pushes her ovipositor into the gallery, pierces the dorsal integument of the young larva and deposits her eggs in the body cavity above the gut. Egg-laying continues until the contents of the ovary are exhausted ; the female makes a minimum of 12 layings and sometimes 24 to 36 layings, so that a single female in the course of a season destroys from one to several dozen larvae.

*Rh. persuasoria* possess well developed poison glands of characteristic size and shape. They include two organs: acid or multifid glands and alkaline or tubular glands ; there is also a poison sac and an excretory canal. These organs must play a considerable part in the preservation of the species ; the liquid injected into the *Sirex* larva at the time of egg-laying must have anaesthetic and preservative properties which prevent the tissues of the larva from decaying.

*Ephialtes manifestator* has a blackish body with the front two pairs of legs reddish and the back pair inclining to black. The female, with the

(1) See also B. April 1917, No. 392.

(Ed.).

aid of its long and flexible ovipositor lays her eggs in the larvae of certain Cerambycidae (*Callidium*), which live in galleries bored in the wood of trees. The egg hatches out in the larva, the latter being thereby killed.

INSECTS, ECC.,  
INJURIOUS  
TO VARIOUS  
CROPS

785 - *Ceratomyza femoralis* ("Wheat-sheath Miner"), a Dipterous Pest of Wheat. — SEAMANS, H. L., in *Journal of Agricultural Research*. Vol. IX, No. 1, pp. 17-25, fig. 1. Washington, D. C., 1917.

*Ceratomyza femoralis* (= *Agromyza femoralis* Meigen) is recorded from Europe and the American Northwest States. In Montana it was reared from winter wheat, spring wheat, oats and timothy. As this insect has only been found on graminaceous plants, it appears that native grasses may be its natural host.

A detailed description is given of egg, larva, puparium and pupa, and adult.

A field of wheat infested with the wheat-sheath miner may not appear to be greatly injured, unless badly infested. Close examination is necessary to estimate the real damage. Injured culms are easily recognized by the fact that while the leaves are mostly green and healthy, the central stalk is dead and withered. The larva bores down the leaf sheath in a narrow clean-cut, and almost straight channel. The larva usually confines itself to mining in the leaf sheath and sometimes girdling the stem without cutting it off. The injuries caused by the mining are sufficient to kill the stalk. Several estimates of the damage caused by the pest in 1915 resulted that the yield of winter wheat had been cut down 25 per cent.

The second brood of the larva causes some slight injury to the plants just before flowering but this injury has little effect on the yield.

The adults emerged (under experimental conditions) from between July 11 to July 24 in 1915, when the females fed by making incisions on the leaves and feeding on the exuding juices. The males appear to feed only on pollen. Oviposition lasts 10 days and probably longer in the field. An average for the number of eggs laid in 24 hours was found to be 16 eggs per fly. The egg is laid under the leaf-epidermis in a puncture formed by the ovipositor. The eggs hatch in about 6 days, and the larval period appears to last about 20 days, depending on weather conditions. The pupal stages (also under experimental conditions) last about 25 days. There seem to be three full broods a year with the hibernation spent as a pupa. The last brood has not been actually reared, but its presence is deduced from various facts.

Two hymenopterous parasites were reared from the puparia of *C. femoralis*, namely a new species of *Dacnusa* (Braconidae) and *Cyrtogaster occidentalis* (Chalcididae). Their control value is uncertain.

As a practical measure of control, burning the stubble as well as the grass borders of the field is suggested, or alternatively, plowing it under and harrowing.

Late seeding, together with the above measure would be useful, as the grain would not be up till oviposition was nearly over.

The wild grasses, being hosts of the pest, should be kept down.



- 786 - **On Some Rhynchota of Economic Importance from Colombia.** — DISTANT W. L., in the *Bulletin of Entomological Research*, Vol. VII, Part. 4, pp. 381-382, pl. IV. London May, 1917.

The list includes: *Trichocentrus gibbosus* How. (?) and *Collaria oleosa* Dist., both injurious to rice fields: *Monalonion atratum* Dist. var. *M. illustris* n. sp. (*M. atratum* var. ?), *M. megiston* Kirk and *M. collaris* n. sp., injurious to cacao pods in Colombia.

- 787 - **The Horse-Radish Flea-Beetle (*Phyllotreta armoraciae* Koch): its Life History and Distribution.** — CHITTENDEN, F. H. and HOWARD, NEALE F., in *United States Department of Agriculture. Bulletin* 535, pp. 1-16, fig. 1-6. Washington, D. C., 1917.

The growing of horse-radish in the North of the United States is menaced by the introduction from Europe of a small Coleopteron known as the horse-radish flea-beetle. The beetle is oval in outline, about  $\frac{1}{8}$  th. of an inch long with yellow elytra bordered with black, and with a longitudinal black band through the middle. The larvae bore into the petioles of horse-radish, and the adults feed on the leaves and gouge deeply into the midribs, causing drying and death.

The beetle was first recognised in U. S. A. at Chicago, Ill., in 1893, since which time its area of distribution has increased until it now occurs from New York and New Jersey to Quebec, Canada, and westward to Nebraska.

The species passes the winter in hibernation as a beetle, coming forth in its northern range in April and May.

While as yet destructive only to horse-radish, its capabilities of becoming a pernicious pest, should it adapt itself to the economically more important cruciferous crops, must be acknowledged, and measures should be taken for its suppression wherever possible.

No systematic control programme has been adopted as yet. Bordeaux mixture, a powerful repellent against flea-beetles, applied on the first appearance of the insect will prevent much injury, and if arsenate of lead is used later it should hold the insect in check.

When a new bed is to be planted a location should be chosen as far removed as possible from any infested bed. It is advisable also to destroy all volunteer plants, not only to keep the insect in check but in some cases to suppress them as weeds.

- 788 - **Notes on the Black Apple Leaf-Hopper (*Idiocerus fitchi* Van D.).** — BRITAIN, W. H. AND SAUNDERS, L. G., in *The Canadian Entomologist*, Vol. XLIX, No. 5, pp. 149-153. Plate IX. London, May 1917.

This insect was first described by FITCH as existing in New York State, but seems to occur generally in the North-eastern United States and Canada. It is also very common in the Annapolis Valley of Nova Scotia.

Contrary to the opinion generally held it has been proved experimentally that *Idiocerus fitchi* Van Duzee does not do serious damage to fruit trees, and that even a large number of these insects in an orchard does not justify the alarm sometimes caused by their appearance.

A description is given of the different life stages of the insect.



FITCH records this species as living on *Crataegus* and OSBORNE mentions it on *C. Oxyacantha* and on crab. In Nova Scotia it is very common on apple and pear trees in spring and early summer.

The eggs begin to hatch several days before the apple blossom petals open and continue for some time after their fall, that is to say, generally from the latter part of May to the beginning of June. The nymphal stage lasts from 7 to 8 weeks. Some days after emergence copulation takes place, and, shortly after this, the eggs are laid. By means of her beak the female makes a hole, usually in the fruit spur, or in a roughened surface on one of the smaller twigs, and deposits an egg therein. There is only one brood a year, the winter being spent in the egg stage.

A bibliography of 8 references is given.

789 - ***Mesolecanium deltae* n. sp. a Gall-forming Scale Insect observed upon Species of Citrus.** — LIZER C., in *Broteria, Série zoológica*, Vol. XV, Part II, pp. 103-107, figs. 1-5. Braga, 1917.

In the neighbourhood of Buenos-Aires and especially in the region of the Paraná delta one often sees upon the leaves of species of *Citrus* a scale-insect which, by means of its punctures, forms little depressions on the lower surface of the leaf with corresponding small swellings upon the upper surface. Within the gall so formed the insect lays its eggs.

When several individuals of the scale insect occur upon the same leaf, this latter takes on a yellowish green colour. When attacked by a single insect the leaf becomes slightly curled; this curling is more pronounced the more numerous the parasites (as many as 25 of the scale insect have been observed upon the same leaf).

This gall-forming insect is described as new to science under the name of *Mesolecanium deltae*. The females, the males not yet being known, are attacked by a microhymenopteron; the writer has observed as many as 5 pupa upon a single scale-insect, but has not yet been able to obtain the perfect insect.

INTERNATIONAL INSTITUTE OF AGRICULTURE  
BUREAU OF AGRICULTURAL INTELLIGENCE AND PLANT DISEASES

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The Bureau assumes no responsibility with regard to the opinions and the results of experiments outlined in the Bulletin.

The Editor's notes are marked (Ed.).

# FIRST PART.

## ORIGINAL ARTICLES

### Sheep and Pig Breeding in the Argentine Republic at the Present Day

by  
GAETANO MARTINOLI

*Professor of Zootechny, Director of the Zootechnical Institute of the Faculty of Agriculture of the National University of Buenos-Aires.*

The 1908 census showed there to be, in the Argentine Republic, 67 211 754 sheep and 1 403 591 pigs. In 1914 the figures were estimated at 81 485 149 sheep and 3 197 337 pigs. These figures show an increase for both kinds of animal, but, in order to form an exact idea, it is wise to await the definite results of the last census, especially in the case of sheep, the total number of which is very uncertain. At present it is only possible to state that, in the Province of Buenos Aires, the sheep continue to decrease rapidly, as is shown by Table I. It is to be hoped that this decrease is only due to an exodus to the lands in the south of the Argentine which are less expensive and, as yet, uncultivated.

#### I. — SHEEP BREEDING.

Table I shows, for the various provinces of the Argentine Republic, the number of sheep given in the censuses of 1888, 1895, and 1908. The estimated number of sheep for 1915 is given for the Province of Buenos Aires only.

TABLE I. — *Number of Sheep in the Argentine from 1888 to 1915.*

Province	Census			
	1888	1895	1908	1915
Buenos-Aires . . . . .	51 537 750	52 630 451	34 604 972	18 528 641
Santa Fé . . . . .	2 977 382	1 988 777	969 406	—
Entre Rios . . . . .	4 901 123	6 210 185	7 005 406	—
Corrientes . . . . .	611 085	1 405 101	3 138 563	—
Córdoba . . . . .	2 355 030	2 594 662	1 992 110	—
Pampa . . . . .	1 670 393	5 295 177	4 809 077	—
Rio Negro . . . . .	287 940	1 009 777	4 724 844	—
Chubut . . . . .	—	47 306	2 123 628	—
Santa Cruz . . . . .	—	369 264	2 387 566	—
Tierra del Fuego . . . . .	282	7 165	1 342 351	—

In 20 years the province of Buenos Aires has lost about  $\frac{2}{3}$  of its sheep, and those in the provinces of Santa Fé and Córdoba are also decreasing. If it were simply a question of change of breeding centres from agricultural districts to more uncultivated ones, no harm would be done, but there would appear to be losses greater than those foreseen and due to: 1) a series of unfavourable years; 2) a high mortality among lambs; 3) loss caused by staggers ("lombriz") and scab ("sarna"); 4) the heavy demands made by home consumption and exportation.

**HISTORICAL DATA:** Like the other domestic animals of the Argentine (1), the sheep are descended from the animals brought by the Spaniards from their native country at the time of the conquest. It is thus that, on the banks of the Plata, are found Churra and Merino sheep; left to themselves, they multiplied rapidly and produced the two local breeds called "pampa" and "criolla" (creole), which represent respectively the degenerated types of the two above-mentioned Spanish breeds.

The "pampa" sheep, found especially in the provinces of the Andes and of the north, were of good height, not very fat, active, with long limbs, white face, long, soft, glossy wool. The males had sometimes 3, or even 4, long, straight horns.

The "criolla" sheep were only used for meat production, and, for a long time, were not shorn. They were smaller than the former breed, with short, coarse wool of varying colour.

For many years only the skins and fat of these sheep were used, for even the lowest classes did not eat the meat, since they had a sufficiency of cattle.

The "graserías" (tallow factories) used millions of sheep, and even their dried bodies were used as fuel in the brick ovens.

When wool began to increase in value and the exportation of agricultural products became of great importance, the breeders began to see the defects of the local breeds of sheep, and began to improve them by crossing with Merinos, first of the Electoral and Negrete type, then of the Rambouillet type. A gradual substitution of one breed for the other took place, giving rise to animals of better conformation producing a much finer and more abundant wool. During this period of "merinomania" (as it was called at its zenith), very high prices were paid for the best breeding stock and, during the years 1836 and 1837, over 4 200 were imported from Germany alone.

But, no sooner did the frozen meat industry start, than the direction of sheep breeding was again changed. Many crossing experiments with the early maturing mutton breeds of the United Kingdom soon showed that, by crossing cross-bred Merinos with Lincolns, animals were obtained which were strong, easy to fatten, relatively early in maturing and producing a long, fine, abundant wool. Towards 1885, the gradual conversion of 40

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(1) On this subject see the preceding articles by the same author: *Horse-breeding in the Argentine Republic at the present day*, in *R. June 1917*, p. 819. — *Cattle-breeding in the Argentine Republic at the present day*, in *R. August 1917*, p. 1073.



million Merino sheep into Lincoln sheep was started. Since then the Merinos still predominate in districts where the influence of the frozen meat industry is not yet felt (Corrientes, Pampa, the south), but the greater part of the national breeding is concerned with the Lincoln type.

IMPROVEMENT OF THE NATIVE BREEDS. — Tables II, III and IV, show the importance of crossing the native breeds and the present day trend of sheep breeding.

TABLE II. — *Creole, cross-bred and pure bred sheep in the Argentine from 1888 to 1908.*

Census	Creole sheep	Cross-bred sheep	Pure-bred sheep
1888 . . . . .	24 322 214 = 36.5 %	42 002 871 = 63.1 %	270 010 = 0.4 %
1895 . . . . .	17 938 061 = 24.1 %	56 106 187 = 75.4 %	335 314 = 0.5 %
1908 . . . . .	10 583 523 = 15.7 %	55 448 749 = 82.6 %	1 179 482 = 1.7 %

TABLE III. — *Proportion of pure breds and cross-breds in the various breeds of sheep in 1908.*

Breeds	Pure-bred	Cross-bred
Rambouillet. . . {		
male . . . . .	25 449	178 441
female . . . . .	205 796	8 551 941
Negrete . . . . . {		
male . . . . .	1 910	4 768
female . . . . .	11 769	370 464
Lincoln . . . . . {		
male . . . . .	56 018	316 817
female . . . . .	367 936	17 566 445
Shropshire . . . {		
male . . . . .	3 905	11 024
female . . . . .	14 149	275 872

TABLE IV. — *Importation of breeding sheep from 1900 to 1914.*

Breed	Number	Breed	Number
Karakul . . . . .	6	Leicester . . . . .	315
Lincoln . . . . .	27 510	Merino . . . . .	291
Rambouillet . . . . .	1 554	Southdown . . . . .	145
Hampshire . . . . .	1 936	Shearling . . . . .	78
Oxfordshire . . . . .	516	Various . . . . .	1 249
Romney Marsh. . . . .	1 783	Total . . . . .	35 383

The figures in Table IV show that, at the present day, two groups of English sheep predominate — the Romney Marsh and the Downs.

The Romney Marsh, which are stronger and more resistant than the Lincolns, but always good breeders for both purposes, were bred in the extreme south of the Republic, where the climatic and food conditions are very difficult. They gave excellent results and are now being bred in other districts, where climatic or other conditions are unfavourable to the Lincoln breed.

As for the Downs, and more especially the Shropshires and Hampshires, they do very well in the "alfalfares" (lucerne fields), and in the good pasture lands, and it seems that, the more small estates increase in

number, and the more intensive agriculture becomes, the more attention will be given to these breeds.

An idea of the relative importance of the various improving breeds can be obtained from Table V, which gives details of the sheep entered in the register of the "Sociedad Rural Argentina" from the 1st. October, 1915 to the 1st. October, 1916.

TABLE V. — *Sheep entered in the register of the "Sociedad Rural Argentina" from the 1st. October, 1915 to the 1st. October, 1916.*

Breed	Definite register		Preparatory register	Total
	Males	Females	Females	
Lincoln . . . . .	2 237	8 953	7 502	18 692
Argentine Merino . . . . .	1 007	2 377	—	3 384
Shropshire . . . . .	57	203	222	482
Hampshire . . . . .	55	219	219	493
Oxfordshire . . . . .	49	86	1 128	1 263
Romney Marsh . . . . .	121	617	584	1 322
Border Leicester . . . . .	9	126	—	135
Corriedale . . . . .	1	—	50	51
<i>Total . . . . .</i>	<b>3 536</b>	<b>12 581</b>	<b>9 705</b>	<b>25 822</b>

The quality of these breeding stock is usually very good, especially that of the Lincolns, Romney Marsh and Downs. A slight deterioration is seen among the Rambouillets, but they still offer a large choice of animals of superior type.

EXPORTATION OF MEAT AND WOOL. — Tables VI to XI give details of the exportation of live and frozen sheep and of wool at different periods.

TABLE VI. — *Exportation of live and frozen sheep from 1876 to 1915.*

Period	Live sheep (1)	Frozen sheep (2)
1876-1880 . . . . .	156 571	—
1881-1885 . . . . .	168 168	—
1886-1890 . . . . .	148 308	3 618 105
1891-1895 . . . . .	778 122	7 091 383
1896-1900 . . . . .	2 335 517	11 521 433
1901-1905 . . . . .	464 287	16 633 163
1906-1910 . . . . .	486 091	14 597 644
1911-1915 . . . . .	480 000	12 217 901

(1) Up to 1903 a large proportion of the live sheep exported went to England, but after the closing of this market most of them were sent to Belgium, Uruguay and Bolivia.

(2) Nearly all the frozen sheep are sent to the United Kingdom.

TABLE VII. — *Total number of sheep slaughtered for home consumption and exportation, from 1910 to 1914.*

1910 . . . . .	5 583 777	1913 . . . . .	3 307 528
1911 . . . . .	6 235 229	1914 . . . . .	4 519 352
1912 . . . . .	4 781 547		

TABLE VIII. — *Exportation of wool from 1829 to 1914.*  
*Quantities and average prices.*

Year	Tons	Average price in gold pesos <sup>(1)</sup> per 10 kg
1829 . . . . .	333.5	—
1850 . . . . .	7 681	—
1860 . . . . .	17 317	—
1870 . . . . .	65 704	—
1880 . . . . .	97 518	—
1885 . . . . .	128 393	2.80
1890 . . . . .	118 406	3.00
1895 . . . . .	201 353	1.54
1900 . . . . .	101 113	2.77
1905 . . . . .	191 007	3.37
1910 . . . . .	150 599	3.91
1914 . . . . .	117 270	4.00

(1) 1 gold peso = 3s.11  $\frac{1}{2}$ d.

(Ed.)

TABLE IX — *Comparative values of various types of wool, from 1904 to 1906*  
*(in paper pesos) (1).*

Wool	1904	1909	1915	1916
Fine Lincoln . . . . .	9-9.3	9-10	12-18	10-17
Medium " . . . . .	9-9.5	8- 8.5	11-18	10-18
Coarse " . . . . .	9-9.7	7- 8	11-18	10-17
Fine Rambouillet . . . . .	8-8.5	9-11	7-11	7-13

(1) 1 paper peso = 1s. 9d.

(Ed.)

TABLE X. — *Price of sheep for the frozen meat industry*  
*on the Buenos Aires market, from 1904 to 1916 (in paper pesos).*

Type	1904	1907	1909	1913	1915	1916
<i>Cross-bred Lincoln Sheep:</i>						
special . . . . .	8-9	8.0-8.5	9.5-10.5	15-20	18-20	15-17
fat . . . . .	7-8	7.5-7.8	9.0- 9.5	—	16-18	11-13
<i>Cross-bred Rambouillet Sheep:</i>						
fat . . . . .	6-7	6.0-7.0	8.0- 8.5	13-14	16-17	11-12
<i>Cross-bred Lincoln Ewes:</i>						
special . . . . .	—	7.5-8.5	7.0- 8.0	15-18	20-22	14-15
fat . . . . .	—	6.0-7.0	7.0- 8.5	12-14	15-17	12-13
<i>Cross-bred Rambouillet Ewes:</i>						
special . . . . .	—	6.0-7.0	6.0- 6.5	13-14	15-17	12-13
fat . . . . .	—	5.0-5.5	5.0- 5.5	11-12	12-13	9-10



These figures need no commentary. The values attained by wool and meat are worthy of note and justify the high prices paid for good breeding animals. Table XI gives the prices realised at the last exhibition of the "Sociedad Rural Argentina".

TABLE XI. — *Prices of breeding sheep realised at the exhibition of the "Sociedad Rural Argentina" (in pesos).*

Breed	Average price		Maximum prices Males
	Males	Females	
Argentine Merino . . . . .	332 pesos	50 pesos	2 500 pesos
Lincoln . . . . .	547	216	4 000
Romney Marsh . . . . .	294	252	670
Corriedale . . . . .	250	—	330
Shropshire . . . . .	300	120	500
Oxfordshire . . . . .	282	100	500
Hampshire . . . . .	305	—	1 000

## II. — PIG BREEDING.

Of all domestic animals, pigs are those which, till recent years, least attracted the attention of the Argentine breeder. This was due to many causes: — 1) they were looked upon as animals which do well only under conditions of intensive breeding; 2) many great failures; 3) the mortality caused by certain diseases (tuberculosis, echinococcosis, distomatosis); 4) the small market demand. Recently, however, new factors have appeared which have greatly modified prevailing opinion and permit a splendid future to be foreseen for the pig industry.

**BREEDING CONDITIONS.** — In various districts of the Argentine, especially in the south of the provinces of Buenos Aires and Córdoba, energetic and intelligent breeders have successfully proved that certain breeds of pigs (especially Berkshire and Poland China) may thrive on pasture only, on condition that it is abundant and completed with a little maize, and that certain hygienic precautions are taken.

In the "alfalfares" (lucerne fields) district, breeding "a campo" (in the open) is very profitable. We have personally visited many breeding farms where thousands of pigs are bred every year with the best results. The pigs are kept in lucerne fields a few acres in size, surrounded by wire fences ("potreros alambrados y alfalfados"); these enclosures are similar to those used in the Argentine for other animals, but are smaller.

With the exception of the mother sows and their young, who are kept in simple and primitive pens (a roof, manger and sub-divisions of wood and iron) (1), all the animals live entirely in the open. In order to prevent their spoiling the pasture by digging and burrowing they are submitted

(1) An original type of pig-sty consists in a cage without a floor, made of laths of wood, which is placed in the lucerne fields daily. The mother sow is shut up in it to browse the lucerne, whereas the young pigs can easily go in and out by passing through the laths. (Author).

This system is described in R. 1914, No. 1031.

(Ed.)

when quite young, to an easy operation called "destrompadura". This operation consists in removing the upper part of the end of the snout. The wound heals, but the place remains tender, and the animal loses the habit of burrowing.

Feeding with lucerne and a little maize suffices to keep the pig in excellent condition, and it is only a few months before it is sold that a larger quantity of concentrated food-stuff is given.

For the two above mentioned breeds (Berkshire and Poland China), two litters of an average of 4 to 6 pigs each, may be relied upon each year. Twelve, or even more, pigs may be kept on 1 hectare (2.47 acres) of lucerne. Berkshire is the favourite breed, but other dark breeds (Poland China and Large Black) are also much in demand and well represented.

The white breeds (especially Middle White) are found on the most intensive breeding farms, usually attached to, or more or less dependent on, large cheese-factories. These breeds cannot bear either the direct and continual sun or great cold, and at present are only in demand by farms which have the necessary conditions for breeding them.

DISEASES. — In open pasture, if the animals are vaccinated against swine plague and regularly dipped in dilute solutions of creolin, there is very rarely a high mortality.

On breeding farms which utilise the residues of cheese-making, if these residues are not sterilised before being fed to the pigs, numerous cases of tuberculosis frequently occur. These are spread by the "tambos" cows (1), which are very subject to this disease.

IMPROVEMENT OF THE CREOLE PIG. — The original or "criollo" pig of the Argentine is descended from breeds imported by the Spaniards. Degenerating completely it has become a wild animal, slow in developing; it is covered with thick, bristling hairs, variously marked, is bony, with long legs, narrow and badly developed body and long, straight head.

By crossing these animals with good English and American stock the breeders have obtained the present day breed.

Table XII gives data on the number of pure-bred and cross-bred animals of various breeds; Table XIII shows the number of breeding stock imported from 1900 to 1914.

TABLE XII. — *Animals entered in the Argentine Swine Book.*

Breed	Male	Female	Total
Berkshire . . . . .	4 220	5 285	9 505
Middle White . . . . .	1 388	1 889	3 277
Large Black . . . . .	1 167	1 278	2 445
Poland China . . . . .	109	136	245
Tamworth . . . . .	85	142	227
Large White . . . . .	43	67	110
Duroc Jersey . . . . .	36	41	77
Lincolnshire . . . . .	—	1	1
<i>Total . . . . .</i>	<b>7 048</b>	<b>8 839</b>	<b>15 887</b>

(1) See the preceding article by the same author: *Cattle-Breeding in the Argentine Republic at the Present Day*, in R. August 1917, p. 1073.



TABLE XIII. — *Number of breeding stock imported from 1900 to 1914.*

Year	Yorksires	Berkshires	Various	Total
1900 . . . . .	—	—	2	2
1901 . . . . .	—	—	—	—
1902 . . . . .	9	—	—	9
1903 . . . . .	12	7	—	19
1904 . . . . .	61	431	—	492
1905 . . . . .	50	117	—	167
1906 . . . . .	35	211	67	313
1907 . . . . .	203	598	140	941
1908 . . . . .	35	327	180	542
1909 . . . . .	25	52	5	82
1910 . . . . .	10	10	—	20
1911 . . . . .	—	10	—	10
1912 . . . . .	—	9	27	36
1913 . . . . .	36	249	128	413
1914 . . . . .	—	43	131	174
Total . . . . .	476	2 064	680	3 220

MEAT INDUSTRY. — This industry, whose modern development dates from about 1900, has undergone various fluctuations, principally due to the prices of pigs and maize. Table XIV shows the variations in the export of frozen pigs from 1885 to 1904.

TABLE XIV. — *Number of frozen pigs imported from 1885 to 1914.*

Year	Number of pigs	Period	Number of pigs
1885-1889 . . . . .	953	1900-1914 . . . . .	798
1890-1894 . . . . .	2 151	1905-1914 . . . . .	Almost none
1895-1899 . . . . .	1 640		

From 1904, certain frozen meat companies undertook only the production of salted and otherwise preserved pig's flesh, thus, for example, the "LAS PALMAS PRODUCE COMPANY, LIMITED" dealt with 12000 pigs in 1908 and 32 000 in 1909. The "Frigorifique Argentin" slaughtered 5 468 animals in 1907. These are certainly not large quantities, but, if it be borne in mind that the total number pigs of slaughtered in the frozen meat factories in 1909 was 25 731, as against a home consumption not exceeding 150 000 animals, it is seen that the figures quoted may be both a help and a stimulant. At the same time, the high prices paid for pork were very profitable, for from 40 to 50 *centavos* and even 60 to 70 *centavos* were paid per kilogramme of live weight. This led to a great boom in this industry for many years, followed by a great depression due to the fact that the frozen meat factories ceased to buy, causing prices to go down. In 1912-1913 there was a new rise, followed by another depression. At the present time the trade is improving.

The exportation of frozen pork was of little importance for several years, and finally stopped altogether (see Table XIV). This trade is now becoming very important since the founding at La Plata of the ARMOUR refrige-



rating establishment, which is capable of dealing with 2 000 pigs a day. The ARGENTINE BACON CURING COMPANY, LTD., has also established at Rosario, a factory for the products of pig's meat.

We feel certain that the right road has now been reached, and do not doubt that, in a few years, the Argentine pork industry will make gigantic strides; this hope is based on the following facts:

1) In the future, countries which might compete with the Argentine will always export less, or under less favourable conditions, either because of the increase in home consumption or because of the distance.

2) Extensive pig breeding with pasture and maize, as practised in the Argentine, makes production easy and cheap.

3) The constantly increasing area under maize will allow, for pig fattening, large stocks of this concentrated food, the price of which will always be sufficiently low to make its use economical.

4) The growth of the dairy industry and the increase in the number of small estates favour the intensive breeding of pigs.

5) The founding of frozen meat and other establishments dealing solely with pig's flesh will regulate prices and give a sure and constant outlet for production.

6) The demand of European markets will become greater, and to them will *perhaps* be added those of the United States, which already import frozen beef from the Argentine.

## SECOND PART. ABSTRACTS

### AGRICULTURAL INTELLIGENCE

#### GENERAL INFORMATION.

DEVELOPMENT  
OF  
AGRICULTURE  
IN DIFFERENT  
COUNTRIES

790 - **The Agricultural Development of North-West India.** — HOWARD, A. and HOWARD, G. L. C. in *The Agricultural Journal of India, Special Indian Science Congress Number* 1917; pp. 67-76. Agricultural Research Institute Pusa, 1917.

The development of the agriculture of North-West India is largely a question of the conquest of an alluvial desert by means of irrigation. The deep soils of this region are practically inexhaustible.

The position of irrigation at the present time is this : Government has provided the country with a magnificent system of canals by which production has been increased and by which large areas of the country have been protected from famine. The farmers, however, do not know the irrigation practice and waste this valuable water, without considering that over-watering on an alluvial soil leads to low yields of poor quality, to accumulations of salts and to destruction of the porosity of the subsoil. The necessity of increasing the supply of organic matter in desert soils is often lost sight of and insufficient use is made of the nitrogen-collecting leguminous crops.

The object of this paper is to suggest a means by which the fertility of the soil in this region can be increased and by which the present supplies of irrigation water can be made to go much further.

It is suggested that the solution of the first problem will be found in the extended growth of *shaftal* (*Trifolium resupinatum*) (1) and similar leguminous crops like lucerne, berseem (*T. alexandrinum*), senji (*Melilotus indica*) and guár (*Cyamopsis psoraloides*), but that no great extension of the leguminous fodder crops is possible unless they can be dried and baled and sold to advantage. On this account trials of baled *shaftal*, by the Quetta garrison, were initiated and developed, which showed that by the use of such fodders the weight of forage taken by an army on active service can be reduced by 25 to 30 per cent. Once the Army comes into the market for

(1) See also *R. August*, 1917, No. 726.

(Ed.)

these dried fodders, their extended use is certain and both cattle and horses now underfed and overworked in urban areas could be improved.

For famine reserves, these baled fodders would be of great use. The water necessary for the extended growth of leguminous fodder crops could be found by the adoption of water-saving methods in the growth of wheat and gram (*Cicer arietinum*), the most important crops in North-West India. Good crops of wheat were obtained by a single watering, instead of the 6 or 7 irrigations now given by the zamindars. This single irrigation should be applied about a week before sowing the wheat and everything should be done to conserve the moisture. This watering enables a good deep-rooting stand of wheat to be obtained and carries on the crop till the winter rains are received. These are conserved by breaking up all crusts with the lever harrow as soon as the land is dry enough. Proceeding in this manner the average experiment Station yields of wheat on large areas, with one watering, were nearly 18 maunds to the acre.

791 - **Studies on the Digestibility of some Vegetable and Animal Fats.** — I. LANGWORTHY, C. F. and HOLMES, A. D., in *United States Department of Agriculture, Bulletins* Nos. 505 and 507, each 19 pp. + tables. Washington, D. C., Feb. 13, and March 24, 1917.

RURAL  
HYGIENE

The digestion experiments with both vegetable and animal fats were conducted by the same methods, so that the results are directly comparable. A basal ration (supplying a minimum of fat) composed of wheat biscuits, oranges, sugar, and tea or coffee, was supplemented by a blanc-mange or corn starch pudding, in which was incorporated the vegetable or animal fats under investigation. The test periods were of three days' or nine meals' duration followed by a rest period of four days in which the subjects, normal young men in good health and moderately active, could eat anything they liked.

Weighings were made of the net amount of food eaten and faeces excreted, and samples of both food and faeces were analysed to determine the percentages of protein, fat and carbohydrate which were actually digested. The detailed results of these analyses are given in a series of tables.

**CONCLUSIONS WITH REGARD TO VEGETABLE FATS:** With allowance for metabolic products, the coefficients of digestibility have been found to be, for olive oil, 97.8; for cottonseed oil, 97.8; for peanut oil, 98.3; for coconut oil, 97.9; for sesame oil, 98; and for cocoa butter, 94.9 per cent. These values indicate that the vegetable fats studied, with the exception of cocoa butter, have for all practical purposes the same digestibility, and are utilised as completely as the animal fats.

The melting points of these fats are considerably lower than body temperature (37° C.) and, in accordance with the theory that fats of low melting points are more thoroughly digested than the harder fats, it has been found that the vegetable fats studied, with the exception of cocoa butter, are utilised practically completely by the body.

The average amounts of fat eaten per subject daily were 73 gr. of olive, 86 gr. of cottonseed, 98 gr. of peanut, 64 gr. of coconut, and 90 gr. of sesame



oils. The limits of tolerance were considerably higher than this, though less for cocoa butter than for the other fats studied.

The digestibility of protein and carbohydrate contained in the different fat diets was not materially affected by the nature of the fat or by the amount eaten.

The total energy values of the material consumed on the average per man per day were 2 700 calories for olive oil, 2 955 calories for cottonseed oil, 2990 calories for peanut oil, 2 305 calories for coconut oil, 2 975 calories for sesame oil, and 2 215 calories for cocoa butter. The percentage of energy actually available to the body was 93.9 for olive oil, 93.4 for cottonseed oil, 93.9 for peanut oil, 93.1 for coconut oil, 92.8 for sesame oil, and 91.9 for cocoa butter.

Judging from the results of the investigation as a whole, it is reasonable to conclude that olive, cottonseed, peanut, coconut and sesame oils are very completely and readily available to the body and that they may, like the animal fats, be satisfactorily used for food purposes.

**CONCLUSIONS WITH REGARD TO ANIMAL FATS:** The fats studied in this investigation were well digested, the coefficients of digestibility, with allowance for metabolic products and any undigested fat supplied by the basal ration, being as follows: chicken fat, 96.7 %; 96.9 %; goose fat, 95.2 %; brisket fat, 97.4 %; butter fat in the form of cream, the fat in egg-yolk, 93.8 %; the fat in fish flesh, 95.2 %.

On an average, 95 gr. of chicken fat, 95 gr. of goose fat, 80 gr. of brisket fat, 78 gr. of butter fat in the form of cream, 83 gr. of egg-yolk fat and 60 gr. of fish fat were eaten per subject per day. In the case of goose fat, a distinctly laxative effect was noted, indicating that the limit of tolerance for this fat was not far above the 95 gr. which were eaten on an average. No physiological disturbance was noted with the other fats tested.

The average coefficient of digestibility of brisket fat is higher than that previously found for beef (kidney) fat (93 %) which is in accordance with the observation that the digestibility is inversely proportional to the melting point.

The consumption of fat did not exercise any unusual effect upon carbohydrate digestion.

As a whole the experiments have shown that the above mentioned fats are all well assimilated and are satisfactory sources of food for the dietary, butter fat in the form of cream and egg-yolk fat being particularly valuable.

792 - **The Maple Sugar and Syrup Industry Schools of Quebec Province in Canada.** — SAVOIE, F. N. (Secretary Provincial Department of Agriculture of Quebec), in *The Agricultural Gazette of Canada*, Vol. 4, No. 7, pp. 591. Ottawa, July 1917.

The three maple sugar-making schools established in 1914 by the Department of Agriculture of the Province of Quebec at Ste. Louise, Beauceville, and La Minerve, were worked during the month of April. The season's results are given in the following comparative table:

Sugar making schools	No. of maples tapped	Gallons of sap gathered	lbs. of sugar made	Gallons of syrup made	No. of pupils	No. of visitors
La Minerve . . . . .	3 000	19 900	55	492	7	38
Ste. Louise . . . . .	4 500	18 580	175	484	44	240
Beauceville . . . . .	3 000	16 400	—	319	5	170

The cost of manufacturing has been higher than usual, on account of the cold temperature and the long sugar season; prices obtained were much better than usual. Syrup of first quality sold for \$1.50 to \$1.75 per gallon and sugar from 14 to 16 cents per pound.

In reply to a large number of requests five instructors, provided with the necessary apparatus, visited several sugar-houses, giving 49 demonstrations in manufacturing and explaining the methods. The demonstrations were attended by 1297 persons from 76 different counties.

## CROPS AND CULTIVATION.

793 - **Studies on the Palaeozoic Soils of North Wales.** — ROBINSON, G. W. (Adviser in Agricultural Chemistry, University College of N. Wales, Bangor), in *The Journal of Agricultural Science*, Vol. VIII, Part 3, pp. 338-384, 2 figs., IX tables. Cambridge, June 1917.

Studies made by the writer in field and laboratory upon the soils derived from material of the Pre-Cambrian, Cambrian, Ordovician and Silurian formations in Anglesey, Carnarvon and Denbigh. This paper is of exceptional interest as, but for the researches of the writer in Shropshire, little or no work has been done on the Palaeozoic soils. The bulk of the experimental work on soils in England has been on soils of Jurassic and later ages.

These researches bring out clearly the differential characters of each of the soils investigated. In mechanical composition it will be noticed that, with the exception of sands, alluvia and peats, the soils of this area are of loam texture. The high proportion of silt and fine silt renders these soils sticky when wet, but on drying they are generally quite friable. It is probable that their friable nature on drying is due to the high proportion of organic matter present. Sedentary soils and soils derived from local drift deposits contain remarkably high proportions of fine gravel, which, in the subsoil, may amount to 40 per cent. Microscopic analysis of the coarser fractions obtained in mechanical analysis show that they are mainly formed of undecomposed parent rock; this is further confirmed by the low silica content as determined by chemical analysis, and in consequence, the soils in question must be placed in the category of Ramann's *Steinboden*, i. e. soils consisting chiefly of slightly decomposed rock fragments.

The North Wales soils are generally deficient in calcium carbonate, in spite of this, however, nitrates can be detected in most of them. It would therefore appear that a type of farming has developed which dispenses with lime.

The high figures for organic matter are readily explained. On the one



hand, the humid climate with its mild winters favours vegetative growth, while on the other, the absence of calcium carbonate hinders aerobic decomposition and promotes anaerobic changes.

Further, the poor aeration of the soil consequent on the interstitial spaces being occupied by water, encourages anaerobic decomposition by which a "sour" peaty humus is produced. The amount of potash present is generally rather high; the same may be said for phosphoric acid.

The Palaeozoic soils of North Wales differ very much from the soils hitherto studied in England. Their agricultural treatment — involving comparatively long periods under grass alternating with arable cultivation — together with the climate, must be considered in devising schemes for manuring and soil treatment. A considerable amount of experimental work in field and laboratory would therefore appear necessary in order to discover to what extent the results of English experiments can be applied to the treatment of North Wales soils.

794 - **The Shrinkage of Soils in the Leeward Islands, British West Indies.** — TEMPANY, H. A., (Government Chemist and Superintendent of Agriculture for the Leeward Islands), in *The Journal of Agricultural Science*, Vol. VIII, Part. 3, pp. 312-330, fig. 1-4. Cambridge June 1917.

The writer has studied quantitatively the contraction produced in soil when it is allowed to dry after having been compacted in a moist condition. These investigations were specially made from the point of view of cacao-growing on certain soils in the West Indies. The method of attacking the problem consisted in determining the linear contraction of a block of soil by means of a special apparatus.

The writer measured a rectangular block of soil before and after drying, and expressed the final linear contraction that took place as a percentage of the original length, when the block contained the water necessary to give the soil its maximum of plasticity. Several determinations were made with 5 typical soil samples from different parts of the Leeward Islands: — a heavy, slightly calcareous clay loam — a heavy non-calcareous loam — a medium non-calcareous loam — a moderately light, non calcareous loam — a light, non-calcareous loam.

If it is admitted that in soils which have been moistened to the point of maximum plasticity, the whole of the water exists in union with the colloidal material present in the soil in the form of a gel, and that this gel occupies the interstitial spaces, and draws together the soil particles as it loses water by evaporation, the normal relation between contraction and water loss appears to be that the cubic contraction ( $x$ ) is equal to the volume of water evaporated from a given quantity of soil. This equality only exists until internal friction among the soil particles restricts the contraction. In fact, in normal soils, a point is reached at which this internal

(1) In accordance with the formula:

$$C = \left( 3a - \frac{3a^2}{10^2} + \frac{a^3}{10^4} \right)$$

where  $C$  is the cubic contraction in % and  $a$  the linear contraction in %.



friction offers sufficient resistance to the contracting gel to cause a progressively increasing departure from the normal relationship. The point at which this departure occurs and the magnitude of the total shrinkage appears to be a function of the amount of colloidal clay contained in any particular example.

It was found on calculating the pore space of the soil ( $\tau$ ) that there is a regular increase in pore space corresponding to a decrease in the linear and cubical shrinkage, and, by means of a graphic calculation, it was estimated that the maximum shrinkage in pure colloidal clay is about 23 per cent.

On this assumption, it becomes possible to calculate the approximate content of colloidal material in any soil from a knowledge of the linear shrinkage. Since the bulk of the colloidal material is contained in the fine silt and clay fractions, the writer tested the validity of this calculation for the fine silt and clay soils and for other soils in the Leeward Islands. It must, however, be noted that by the ordinary method of physical analysis it is difficult to determine the exact amount of the colloidal content of a soil, since the colloidal material is contained in the four fractions designated silt, fine silt, clay, and organic matter.

795 - **The Influence of Soil Conditions on the Decomposition of Organic Matter in the Soil.** — RUSSELL, E. J. and APPELYARD, A. (Rothamsted Experimental Station), in *The Journal of Agricultural Science*, Vol. VIII, Part 3, pp. 385-417, figs. 1-9. Cambridge, June 1917

The biochemical decomposition of plant residues and other organic matter in the soil is of fundamental importance for soil fertility. Though, in large part, the decomposition is brought about by bacteria and other microorganisms in the soil, no definite connection has been traced in the field between the activity of the microorganisms and the extent of the change. The writers decided that the best means of studying the connection was to follow the development of the bacteria and the decomposition on given plots of ground during a long period. They therefore followed for 3 consecutive years the changes in amount of nitrate in the soil, of carbon dioxide in the soil air and of bacterial numbers on 5 plots of ground at the Rothamsted Experimental Station. The plots were as follows: 1 unmanured fallow plot — 1 dunged fallow plot — 1 dunged, cropped plot — 1 unmanured cropped — 1 manured and farmed in the ordinary way.

There is sufficient resemblance between the curves for bacterial numbers, carbon dioxide (except for a period on cropped land) and nitrate to justify the conclusion that they are all related. The curve for nitrate is always behind that for bacterial numbers, the lag amounting to 2 or 3 weeks. This would seem to indicate that there are 2 stages in nitrate production; these stages are not simply ammonia production and then nitrate production, but apparently the ammonia production is also divided into 2 stages. On the other hand, the biochemical decompositions in the soil are determined in the first instance by the temperature and do not proceed

(1) According to the formula  $P = \frac{D_1 - D_2}{D_1} + 100$ , where P is the pore space in %,  $D_1$  the actual density and  $D_2$  the apparent density of the soil.

to any notable extent below 5° C. As soon as the temperature rises, action begins rapidly, but it soon slows down and other factors begin to operate. Moisture is one of these factors, and it was found that action came to a minimum when the moisture fell to 10 per cent. by weight of the unmanured soil and 15 per cent. by weight of the dunged soil. Rainfall is an even more important factor, a shower of rain having notable effect in starting the decompositions. It seems probable that the dissolved oxygen in the rain is an important factor here. The growing crop (wheat, potatoes or oats) exerts a depressing effect on the decomposition, though whether by taking up the dissolved oxygen, by giving out carbon dioxide, or by some other action, is not clear. The fluctuations in bacterial numbers are not wholly explicable as functions of the temperature and moisture content; in fact some of the rises and falls are of the kind obtained during the investigations on partial sterilisation. Further work on this problem is at present being carried out at the Rothamsted Laboratory.

PERMANENT  
IMPROVEMENT.  
DRAINAGE  
AND  
IRRIGATION

796 - **Irrigation in Various States and Colonies.** — BORGHESANI, G. A. R., *Commissione Reale per studi e proposte relative ad opere d'irrigazione, seconda Relazione presentata al Parlamento dal Presidente Onorevole Girolamo Giusso, Senatore*. Part 3, pp. I-VII + 146 + 1 map. Bergamo, 1916.

This monograph is a study on irrigation in various countries, especially in arid and semi-arid districts.

The introduction, after general historical and geographical considerations, gives the physiographical bases of a comparative study of irrigation works, taking, as point of departure, the division into arid, semi-arid, semi-moist and moist districts proposed by WINTSOE. In the first place, it is seen that 55 % of the earth's surface receive less than 500 mm. of annual atmospheric precipitation. These form the arid or semi-arid districts, which, in order to be cultivated, require special treatment, either irrigation or dry farming. Moreover, part of the semi-moist districts, with an atmospheric precipitation of 500-1000 mm., also require irrigation or means of preserving the water on account of the uneven distribution of the precipitation during the year. It thus happens that 65 % of the earth's surface, that is to say, 87 millions of square kilometers (1) have a minimum of water. It is, however, estimated that it is possible to irrigate only 13 500 000, or about  $\frac{1}{10}$ , of the total land surface. Of this, 7 million square kilometers are already under irrigation, leaving 6 500 000 square kilometers yet to be irrigated.

From a point of view of irrigation the different countries have been classified as follows:

a) countries in which irrigation is *obligatory*; these include countries with an atmospheric precipitation below 250 mm. and where cultivation can only be carried out by means of water brought from outside. These countries are situated in the desert or sub-desert districts where the geographical and tectonic conditions allow water to be brought from great



distances or great depths. Egypt and the desert oases are typical of these lands.

b) countries in which irrigation is *necessary*; these include the semi-arid lands with 250 to 500 mm. of atmospheric precipitation. It is in these countries that irrigation gives the best results and is generally employed, for it is easy to bring the water from superficial streams or underground beds. Here irrigation is the indispensable complement of dry-farming, that is to say, that, in these districts, both dry farming and farming by means of irrigation are found. Countries typical of these conditions are: the western United States; Algeria and Tunis; Spain; Australia; South Africa; Chili; Argentina and Peru; and such should also be the semi-arid districts of Italy, western Liguria; Sardinia; Sicily; Basilicata; Apulia and other districts of the Adriatic;

c) countries in which irrigation is *supplementary*; these include the sub-moist districts with atmospheric precipitation of 500 to 750 mm., in which, theoretically, there is sufficient water, but where, owing to the bad distribution of the precipitations in the different seasons, either dry farming or farming by irrigation are useful. These countries are either intermingled with or bordering on those of the preceding groups, although they are sometimes in contact with the following category; such are, for example, certain districts of north-eastern Germany; the south-west of France; a great part of central Italy, of Australia and of the United States, etc.;

d) countries in which irrigation is *optional*; under this heading come the moist districts where irrigation is usually practised for special intensive crops. Types of these are: the rice-fields of southern Italy, of the south-western United States, of Siam, of Cochin China, of China, of Japan and of the Dutch Indies; the "marcite" of Lombardy; numerous suburban districts where horticulture and arboriculture are carried out intensively.

In order to illustrate the subject under discussion the text is accompanied by an *udometric planisphere of irrigation*, in which the globe is divided into 4 large districts: — arid, semi-arid, sub-moist and moist, giving the political divisions in which public provision with regard to irrigation is made.

The irrigation of various countries is then described, special attention being given to countries which represent specific types of irrigation of arid and semi-arid districts. The countries studied are: Argentina; Germany; Austria; Hungary; Belgium; Chili; China; Cuba; Denmark; Egypt; Spain; United States; France; Algeria and Tunis; Madagascar; Indo-China; United Kingdom; Australia; Canada; Ceylon; India; South Africa; Japan; Mexico; Dutch East Indies; Peru; Russia; Siam; Switzerland.

The last part summarises the general principles laid down in the chapters on each country, and it is shown that the technical progress and application of irrigation are gradually attracting more and more the attention of statesmen, especially in those countries where agricultural production is most urgent, and where water forms the decisive factor.

In conclusion the following principles for the irrigation of arid zones in general are given:



- 1) the utilisation of superficial, sub-soil and deep waters by all the means in the power of modern technology ;
- 2) technical State assistance in the utilisation of the various water reserves suitable for irrigation ;
- 3) Financial State aid for irrigation work if private capital cannot find immediate interest ;
- 4) an appropriate distribution of the reserve waters suitable for domestic, agricultural and industrial uses, so that its use for the last purpose shall not be detrimental to the other two more important ones ;
- 5) technical assistance given to those engaged in irrigation farming so that they may make the most economical use of the water at their disposal ;
- 6) the institution of homesteads for those engaged in irrigation farming as this is the only method which will allow the maximum economical utilisation of the water ;
- 7) the recognition, with the requisite support, of all irrigation works and enterprises which have been neglected by competent technical bodies to be of public utility.

An appendix gives a bibliography of 643 works.

MANURES  
AND MANURING

797 - **The Fixation of Nitrogen in Faeces.** — RICHARDS, E. H. (Rothamsted Experimental Station), in *The Journal of Agricultural Science*, Vol. VIII, Part. 3, pp. 299-311. Cambridge, June 1917.

In the course of a general study of the chemical changes taking place in the manure heap, a number of experiments were made with the object of determining the loss of nitrogen during the aerobic fermentation of urine, straw and faeces ; in the case of the last, however, instead of a loss of nitrogen, appreciable gains were recorded, and this decided the writer to devote special attention to the subject of this article.

He states in the first place, that horse faeces contains material capable of fixing nitrogen when fermented aerobically in presence of sufficient moisture and calcium carbonate. This fixation is a function of the diet, for when horses are fed on grass alone, instead of oats and hay, the amount of nitrogen fixed is much reduced. Under the most favourable circumstances, 1 gram of dry matter in the faeces will fix 4 mgms. of nitrogen. Bullock faeces will also fix nitrogen, but to a much smaller extent than horse faeces. This is also a function of diet, for it only occurs when the animals are fed with cake ; on grass alone, no nitrogen is fixed.

The writer has found that the organisms concerned in the fixation of nitrogen are present in garden soil. Fixation is brought about by a mixed culture of *Azotobacter* and *B. lactis aerogenes*. Of these, the latter is normally present in faeces, and though *Azotobacter* is not, it readily infects faeces. The inoculation of faeces with both organisms fixes a considerable amount of nitrogen which disappears after sterilisation. Raw faeces, when inoculated with soil, also fixes nitrogen ; this fixation power was retained after sterilisation in the autoclave in some experiments which gave the greatest increase in nitrogen. It therefore seems probable

that the nitrogen fixation is only a last link in a chain of biological changes brought about by organisms normally present in the faeces or soil.

The practical importance of this fixation is probably small; at most it means that when a soil is manured with horse dung, there is a possible addition of atmospheric nitrogen, which may amount, under the most favourable conditions, to 30 per cent. of the nitrogen in the complete manure.

On the other hand, the discovery might be of practical use in increasing the nitrogen of the soil, by fixing atmospheric nitrogen on industrial bye-products containing actual or potential food for organisms of the types active in horse faeces.

798 - **Water Hyacinth (*Eichornia Crassipes* Solms.) and its Value as a Fertiliser.**

— FINLOW, R. S. (*Fibre Expert to the Govt. of Bengal*) and McLEAN, K. (*Deputy Director of Agriculture, Eastern Bengal*), in *The Agricultural Journal of India*, Vol. XII, Part III, pp. 419-424. Calcutta, July, 1917.

*Eichornia crassipes* Solms, belonging to the Family Pontederiaceae, is a native of South America, but has now become a troublesome weed in other countries, notably Florida, Java, Australia and India where it seriously interferes with river navigation. It is a herb which multiplies extensively by division of the root-stalk. In Burma it has been described as one of the greatest administrative problems at present confronting the Government.

The plant has been examined from the point of view of its agricultural possibilities and results have been obtained of considerable importance.

The following is an approximate analysis of the fresh plant :

	Per cent.
Moisture . . . . .	95.50
Organic matter (Nitrogen, 0.04 %) . . . . .	3.50
Ash (Potash, 0.20 % — $P_2O_5$ , 0.06 %) . . . . .	1.00

The analytical figures indicate that the rotted water hyacinth is about as rich as farmyard manure, of the same water content, in nitrogen, phosphoric acid and lime, but contains several times as much potash.

The ash is about 1 % of the fresh green weight and its approximate content of important constituents is as follows :

	Per cent.
Potash . . . . .	28.7
Soda . . . . .	1.8
Lime . . . . .	12.8
Phosphoric acid . . . . .	7.0
Chlorine . . . . .	21.0

The chlorine in the above is just enough to combine with the whole of the potash, and therefore the sample contained nearly 50 % of its weight of chloride of potash.

Field experiments have shown that the rotted plant applied as manure has a remarkable effect upon the jute crop, giving an increase over the normal of six maunds (480 lbs.) of fibre, worth Rs. 50 per acre. 500 maunds



(40000 lbs. or about 18 tons) of the green plant will supply the following approximate amounts of plant food:

	lbs.
Nitrogen . . . . .	20
Potash ( $K_2O$ ) . . . . .	80
Phosphoric acid ( $P_2O_5$ ) . . . . .	35
Lime . . . . .	60

Obviously, owing to its bulk and high water content, the water hyacinth could not be economically transported over large distances. The dried plant is the only convenient form for transportation and contains from 1.5 % to 2 % of nitrogen and from 20 % to 25 % of ash, including about 8 % of potash ( $K_2O$ ).

Messrs. Shaw, Wallace and Co. of Calcutta, have offered to buy any quantity of hyacinth ash at Rs. 4 per unit of potash ( $K_2O$ ) landed in Calcutta. This is equivalent to from about Rs. 84 to Rs. 120 per ton of the ash.

799 - **The Solubility of Calcium Phosphates in Citric Acid.** — RAMSAY, A. A. (Chemical Laboratory, Department of Agriculture, Sydney, N. S. W.), in *The Journal of Agricultural Science*, Vol. VIII, Part. 3., pp. 277-298. Cambridge, June 1917.

These experiments were made by the writer in order to determine the extent of the solubility of phosphates in 2 per cent. citric acid. He states, in the first place, that the substances sold as "Phosphate of Lime" and "Calcii Phosphas" B. P., are mixtures of di-calcic and tricalcic phosphates; this mixture is always obtained when calcium phosphate is prepared by precipitation with ammonia.

Pure tricalcic phosphate is only obtained when 3 equivalents of lime are made to act on 1 equivalent of phosphoric acid, the resulting precipitate being removed with little delay.

If the tricalcic phosphate thus obtained is treated with a 2 per cent. citric solution in the ordinary manner for 30 minutes, 91 per cent. of the phosphoric acid becomes soluble, but, if calcium carbonate is added, the solubility of the phosphoric acid is reduced to 84.4 per cent. by the addition of 14 per cent. of lime as carbonate, while the further addition of 14 per cent. of lime as carbonate reduces the solubility to 84.3 per cent.

Since the whole of the excess of lime, beyond that present as tricalcic phosphate, goes into solution in the first 30 minutes of extraction with a 2 per cent. solution of citric acid, the latter is more correctly a solvent for lime than for phosphoric acid. Pure tri-calcic phosphate is largely soluble in 2 per cent. citric acid, as are also the so-called dicalcic and tricalcic phosphates produced by precipitation in presence of ammonia. It therefore follows that since dicalcic and tricalcic phosphates are both soluble in the prescribed 2 per cent. citric solution, the statement that dicalcic phosphate can be differentiated from tricalcic phosphate by means of the selective action of this solvent is untenable.

Therefore the manurial value of phosphates cannot be determined by a 2 per cent citric acid solvent in the method prescribed and it is thus a matter for consideration as to whether the further use of this method should be continued.



800 — The Resistance of Wheat to Cold in Relation to its Sugar Content ; Investigations carried out in Sweden. — AKERMAN, A. and JOHANSSON, H., in *Sveriges Utsädeforenings Tidskrift*, Year 27, Pt. 2, pp. 77-83. Molmøe, 1917.

During the last 10 years it has been proved that the resistance of plants to low temperatures is due, in part at least, to the presence of sugars (saccharose, glucose, mannite, etc.) in the cell sap. With regard to the Gramineae, GASSNER and GRIMMER have observed that the water extract of autumn cereal seedlings gives a much stronger reaction with Fehling's solution than the water extract of spring cereals treated with the same reagent.

The experiments described were undertaken to determine whether the various degrees of resistance to cold of the principal Swedish wheats really are due to a more or less strong concentration of the sugars in solution. Three series of experiments were made of which the analytical results are included in the 3 tables given below: — I. Young plants, analysed immediately after picking after having been treated with ether. — II. Young plants, analysed after having been dried at 70° C. — III Young plants, analysed after soaking in ether during several days.

1st. Series. — Wheats studied. — "Tystofte Smaahvede II" and "Svenskt Sammetsvede" ("Landtvede"); the latter is characterised by a marked resistance to low temperatures.

TABLE I. — Results of the 1st. Series of Experiments.

Varieties	Dry matter in percent. of fresh matter	Glucose in percent. of dry matter								
		I			II			III		
		Minimum	Maximum	Average	Minimum	Maximum	Average	Minimum	Maximum	Average
Smaahvede II. . . . .	23.0 %	8.5%	9.0%	8.8%	7.7%	8.7%	8.0%	9.4%	10.4%	9.8%
Sammetsvede . . . . .	25.5	16.0	17.4	16.7	17.7	18.4	18.0	18.5	19.4	19.0

It is seen that the resistance to cold of the "Sammetsvede" variety is accompanied by double the quantity of glucose contained in the "Smaahvede" variety.

2nd. Series. — Besides the 2 preceding varieties "Sol" wheat was also studied. This variety is a little more resistant to cold than "Smaahvede" but rather less so than "Sammetsvede", with a glucose content intermediate to these two varieties, as is seen by Table II.

In this 2nd. series the material dried at 70° C. contains the least reducing sugars, and the material soaked in ether for several days before analysis contains the most.

3rd. Series. — To the above varieties was added "Thule II" wheat, obtained by crossing "Sammetsvede" × "Pudel". In all experiments in various parts of Sweden this wheat had proved more resistant to cold than "Sol" but less so than "Sammetsvede".

TABLE II — *Results of the 2nd. Series of Experiments.*

Varieties	Dry matter in percent. of fresh Matter	Glucose in percent. of dry matter								
		I			II			III		
		Minimum	Maximum	Average	Minimum	Maximum	Average	Minimum	Maximum	Average
Smaahvede II . . . . .	19.6 %	7.4%	8.1%	<b>7.5%</b>	6.2%	7.1%	<b>6.7</b>	7.7%	8.3%	<b>8.0%</b>
Sol. . . . .	20.2	8.7	10.0	<b>9.6</b>	8.2	9.1	<b>8.6</b>	10.0	10.8	<b>10.4</b>
Sammetsvede . . . . .	23.7	14.6	16.2	<b>15.2</b>	13.4	13.9	<b>13.7</b>	14.9	16.5	<b>15.5</b>

TABLE III. — *Results of the 3rd. Series of Experiments.*

Varieties	Dry matter in percent. of fresh matter	Glucose in percent. of dry matter								
		I			II			III		
		Minimum	Maximum	Average	Minimum	Maximum	Average	Minimum	Maximum	Average
Smaahvede II. . . . .	23.2 %	13.4%	14.5%	<b>14.1%</b>	13.5%	14.2%	<b>13.8%</b>	—	—	—
Sol. . . . .	23.8	15.3	16.1	<b>15.7</b>	14.8	14.9	<b>14.8</b>	—	—	—
Thule II, . . . . .	24.7	17.8	18.4	<b>18.0</b>	16.9	17.2	<b>17.1</b>	—	—	—
Sammetsvede . . . . .	26.0	20.8	21.6	<b>21.1</b>	19.0	20.0	<b>19.6</b>	—	—	—

It is therefore seen that in all the cases examined a perfect parallelism existed between the resistance to low temperatures and the sugar content.

**801 — Temperature and Life Duration of Seeds; Experiments made in the United States.** — GROVES, JAMES FREDERICK (Contribution from the Hull Botanical Laboratory 226), in *The Botanical Gazette*, Volume LXIII, No. 3, pp. 169-189, 5 fig. IV plates. Chicago, Illinois, March 1917.

In the appendix there is a bibliography giving 33 publications mentioned in the text of the article.

A study of the effect of high temperatures (from 50° to 100° C.) upon the life duration of seeds of wheat (Turkey-red variety) with a somewhat low moisture content (9 % — 12 % — 17.5 %).

An easily handled thermostat of simple construction is used. The seeds are placed, 100 at a time, in securely-corked test tubes which are plunged into a bath of water and alcohol in the inner vessel of the thermostat, the temperature being regulated by an automatic electric apparatus. After the seeds are heated, they are removed from the thermostat and washed for 2 or 3 minutes in a  $\frac{N}{50}$  solution of silver nitrate and then washed thoroughly in distilled water to remove the excess of silver nitrate. The seeds are germinated in large Petri dishes containing a layer of moist cotton wool covered with a layer of filter paper.



By determining the time required to kill seeds at any two definite temperatures, the time for killing seeds at any other temperature can be calculated by means of LEPESCHKIN's formula:  $T = a - b \log Z$ , in which  $T$  is the temperature in degrees centigrade,  $Z$  is the time in minutes, and  $a$  and  $b$  are constants.

If the loss of viability of seeds during storage is a matter of coagulation of cell proteins of the embryo, this time-temperature formula for the coagulation of proteins should be applicable as a temperature-life duration formula for seeds. To ascertain whether this was the case was the object of the present experiments. The results obtained were positive. In fact, the values found and those calculated by means of LEPESCHKIN's formula coincide within relatively small limits of error: 0.6 per cent. for 9 per cent. of moisture: 0.8 per cent. for 12 per cent., etc.

The following is a summary of the most important results:

1) The life durations of wheat with 9 per cent moisture at the various temperatures are:

Temperatures	90.8°C	85.7°	84.2°	83.5°	79.8°	74.4°	70.8°	66.0°	60.6°	56.3°
Life durations (minutes) . . .	8	27	45	63	140	435	810	2 340	7 200	19 440

Thus, as the temperature diminishes, the resistance and life duration of the seeds rapidly increases: from 8 minutes at 90.8° C. to 13 1/2 days at 56.3° C.

2) The life durations for 12 per cent moisture are:

Temperatures	92.2°	87.7°	87.5°	87.5°*	84.4°*	84.4°	78.9°*	79.1°	78.5°*	75.8°	71.3°
Life durations (minutes).	7	8	9	10*	15*	18	45*	50	50*	120	315

\* Values obtained in the experiment, but not used in the theoretical curve, as they show some deviation.

The life durations for 17.5 per cent moisture are:

Temperatures	87.1°	83.6°	83.1°	79.5°	74.7°	70.5°	64.4°	60.6°
Life durations (minutes) . . . .	3.0	3.75	4	5.5	8.0	23.0	140.0	440.0

Thus, the temperature being the same, the life duration diminishes rapidly as the moisture content of the seeds increases.

Can the LEPESCHKIN formula be applied as a life duration formula for wheat seeds at lower temperatures, including ordinary storage tempera-



tures? It would appear not, for the values obtained are much higher than those found by WHITE and other writers. This may be due to:

1) Increase of acidity of seeds, which at low temperatures hastens the coagulation of the cell proteins.

2) A slight error in the value of the constant  $b$ . The probability of this error increases as the temperature diminishes. If it were possible to estimate these causes of error and to allow for them, LEPESCHKIN'S formula would certainly permit of a very approximate calculation being made of the life duration of cereals under ordinary storage conditions.

802 - **The Influence of Light on the Germination of the Seeds of Different Varieties of *Nicotiana Tabacum*.** — HONING, J. A., in *Bulletin van het Deli Proefstation*, No. 7, pp. 1-14. Medan, December 1916.

According to RACIBORSKI (1) tobacco seeds do not germinate in the dark, a fact that is confirmed by experiments at the Deli Station. Therefore the writer was much surprised at GASSNER'S (2) classification of seeds, wherein he placed the seeds of *Nicotiana tabacum* in the group of seeds insensible to light. As he found 80.5 % germination both for seeds in diffuse daylight, as well as in darkness, probably there must exist large differences between the varieties of *Nicotiana tabacum* in the need of light for germination.

An experiment with many varieties proved this supposition to be true. Just as RACIBORSKI states, the Deli-tobacco cannot germinate without the presence of light, (or only a very small percentage germinates), and the differences between the seeds of different origin or plants are small. But there are some other varieties which germinate in darkness almost as well as in light, though somewhat more slowly.

Experiments were carried out with 51 samples of seeds, 8 of Deli-tobacco, 6 of West or Central European types, received from Scafati, 14 samples of varieties from the Balkans and Asia Minor, also from Scafati, and 21 of American species received from Washington, 1 of *Nicotiana quadrivalvis* and 1 of *N. rustica*. As a rule types from the Balkans and Asia Minor are the quickest in germinating in darkness and give the highest percentages.

Of the American varieties, some do not germinate without irradiation, just as Deli-tobacco, and others germinate for a small percentage, not a single one coming above 50 %.

The types from West and Central Europe take, with one exception, an intermediate position.

Only the seeds of *Nicotiana quadrivalvis* agreed in their behaviour in darkness with the sample of *N. tabacum* used by GASSNER.

(1) RACIBORSKI, M., *Ueber die Keimung der Tabaksamen*. Lands Planteantuin Bulletin de l'Institut botanique de Buitenzorg No. VI, 1900.

(2) GASSNER, G., *Einige neue Fälle von keimungs-auslösender Wirkung der Stickstoffverbindungen auf Lichtempfindliche Samen*. Ber. d. d. bot. Ges. Bd. XXXIII, S. 217-232, 1915.

803 - **The Influence of Mineral Matter on the Germination of Peas (1).** — MAQUENNE, L. and DEMOUSSY, F., in *Comptes rendus des Séances de l'Académie des Sciences*, Vol. 165, No. 2, pp. 45-51. Paris, July 9, 1917.

The influence of metallic salts on germination varying with the nature of the mixtures in which they occur, the writers have determined the action which each single salt exercises when alone and dissolved in perfectly pure water.

In Table I, the weights indicate the absolute quantities of active substance regarded as anhydrous which have been added to the water moistening the sand, that is to say, placed at the disposal of 10 seeds; the aluminium was administered in the form of potash alum.

TABLE I. — *Length (in mm.) of the roots after 24 hours' soaking and 6 hours' germination.*

Salts employed	Weight of active substance						
	0 mg.	0.10 mg.	0.25 mg.	0.50 mg.	1 mg.	2 mg.	5 mg.
	Length of roots						
Sodium chloride . . . . .	26 mm	26 mm	25 mm	26 mm	26 mm	33 mm	41 mm
Potassium chloride . . . . .	23	23	24	24	23	24	25
Ammonium sulphate . . . . .	26	26	25	26	31	33	36
Calcium sulphate . . . . .	30	42	58	79	74	75	78
Strontium chloride . . . . .	25	31	36	38	35	44	34
Barium chloride . . . . .	26	28	33	31	26	25	19
Magnesium sulphate . . . . .	27	25	27	30	34	35	32
Zinc sulphate . . . . .	24	24	24	24	20	19	17
Manganous chloride . . . . .	27	30	30	39	39	42	40
Aluminium sulphate . . . . .	26	26	27	34	34	33	24
Lead chloride . . . . .	25	26	26	26	24	17	15
Copper sulphate . . . . .	26	26	24	25	17	14	10

It can be seen that, apart from the case of calcium, which is exceptional, the differences remain fairly slight up to the proportion of 0.05 mg. of salt per seed, corresponding to,  $1 \frac{1}{2500}$  of its dry weight; however, the general facies of the seedlings distinctly changes when one passes from one metal to another.

Calcium appears to be the only body which, in the absence of all others, is capable of ensuring the normal germination of peas at the outset. With a proportion of 0.01 mg. per seed of the sulphate or chloride, which corresponds to 0.003 mg. of the metal, i. e., to about  $\frac{1}{40000}$  of the weight of the dry seed, the length of the roots increases by nearly one half and absorbent hairs begin to appear. Its action, therefore, begins to make itself

(1) See R., August 1917, No. 717.



felt in extraordinarily small proportions, inferior to those in which the majority of poisons begin to produce an effect. M. COUPIN (1) has shown that calcium salts in excess hinder the formation of hairs on the roots of *Lepidium sativum*. On comparing this statement with those of the present writer there are grounds for concluding that the production of root hairs is, on the part of calcium, a proof of favourable action and thus also of a proportion suited to the needs of growth. On the other hand their checked development and *a fortiori* their absence constitute a proof of poisoning by an excess proportion.

Vegetable matter possesses a powerful affinity for lime which is one of the indispensable factors for the beginnings of plant life. The seed does not contain in itself a proportion of lime sufficient for its needs. Analysis of the seed from the point of view of alkaline earths only gives the results shown in Table II.

TABLE II. — Analysis of seed (alkaline earths).

Proportion per cent. of seeds	Total ash per cent.	Lime per cent.		Magnesium per cent.		Absolute weight per seed		
		of ash	of organs	of ash	of organs	of organs	Lime	Magnesium
11.52 %	2.80 %	19.90 %	0.56 %	13.92 %	0.39 %	14.50 mg	0.081 mg	0.057 mg
88.48	2.95	1.51	0.04	7.82	0.23	112.00	0.050	0.259
—	2.93	3.53	0.14	8.49	0.25	126.58	0.131	0.316

In proportions less than those in which they are toxic and in the conditions of the actual experiments, the harmful metals did not favour the growth of the roots.

After calcium, at the rate of 0.05 mg. per seed, at which proportion the toxic elements employed do not produce any effect, there come strontium, manganese, aluminium, barium and magnesium much less favourable, then the alkaline metals, zinc, lead and copper, which seem to have no immediate effect.

This study of the development of the roots is to be followed by another on that of the stems.

804 — The Influence of Hot-Water Treatment on the Germination Percentage of the Seeds of *Albizzia Moluccana* Miq., *Pithecolobium Saman* Bth., *Mimosa invisa* Mart. and *Crotalaria striata* D. C. — HONING, J. A., in *Bulletin van het Deli Proefstation* No. 7, pp. 15-24. Medan, December 1916.

The hard seeds of *Albizzia moluccana*, *Pithecolobium Saman* and *Mimosa invisa* can be forced to germinate by treating them with hot water. The use of boiling water, however, as recommended for *Albizzia* by some authors, is very disadvantageous; sometimes all the seeds are killed; and even 80° or 70° C. is too high when the temperature decreases slowly and remains at this height for half an hour or more.

For *Albizzia* the best water temperature for soaking the seeds is about 60° C. Fresh hard dried seeds may stand 70° C. very well; but 60° C. is sufficient and for older seeds far better.

(1) Cf. *Comptes rendus de l'Académie des Sciences*, Vol. 164, 1914, p. 641.

(Ed.)



Seeds put in water at 80-100° C. showed a higher percentage of germination on filter paper than in sand. Nevertheless most of them were so much damaged that, after pushing out the root top through the seed coats, the seeds were not able to grow further and died. Seeds, soaked in water at a lower temperature or not soaked at all, germinated better in sand.

The best results with *Pithecolobium* seeds were obtained by using water at 70° C., thus 10° C. higher than for *Albizzia*, and even 80° C. gave a higher percentage than 60° C. The *Pithecolobium* seeds are more resistant against hot water and need a higher temperature.

The *Mimosa* seeds also showed the highest percentage of germination after treatment with water at 70° C.; but 80° C. is harmful and gives a smaller proportion (13  $\frac{3}{4}$  % in sand) than 60° C. (40  $\frac{3}{4}$  % in sand). Without hot water treatment the germination is very bad, even in sand, at best 10 %.

*Crotalaria* seeds are damaged by all temperatures above 50° C. The influence of water of 50° C. was quite the same as that of 27° C., in both cases there germinated in sand 38  $\frac{1}{4}$  %; on filter paper 51  $\frac{1}{2}$  and 50  $\frac{1}{2}$  %. Without previous soaking the results in sand were better, 32  $\frac{1}{4}$  and 26  $\frac{1}{2}$  on filter paper. Hot water is very injurious in this case.

#### 805 - The Fertilisation of Gramineae and Leguminosae in Relation to Selection. —

FRANSEN, N. H. (Director of Experiments at Otoftegaard, Province of Toastrup, Denmark), in *Zeitschrift für Pflanzenzüchtung*, Vol. V, Pt. 1, pp. 1-30. Berlin, March 1917.

This paper describes work carried out at the Experimental Station of Tystofte (Denmark) on species of Gramineae and Leguminosae, in order to determine, by observing the course of flowering in plants which flower freely and by experiments on the isolation of the flowers or inflorescences: 1) to what degree self-pollination and self-fertilisation can occur in these species; 2) to what degree self-fertilisation or cross-fertilisation may eventually occur when these plants flower freely. The experiments were carried out during the summers of 1910, 1911, and 1912 with the following species: *Dactylis glomerata*, *Festuca pratensis*, *Lolium italicum*, *L. perenne*, *Phleum pratense*, *Alopecurus pratensis*, *Poa fertilis* Host, *Bromus arvensis*, *Trifolium pratense*, *Lotus corniculatus*, *Medicago sativa*, *M. lupulina*. The investigations of T. WESTERMANN on *Dactylis glomerata*, *Phleum pratense* and *Bromus arvensis*, as well as other publications on the subject studied, have been taken into consideration. In order to isolate the Gramineae parchment or cotton bags or glass cylinders were used and, to isolate the Leguminosae, bags of thin gauze.

The following methods of pollinisation were used for the Gramineae:

- 1) Pollination in the same plant (pollination by the neighbour, "geitonogamy") with isolation of one, two, or several inflorescences at the same time.
- 2) Pollination by the pollen of another plant (cross pollination) either by common isolation of two or more inflorescences of the same plant and by suspension of the flowering ears or panicles of other plants, or else by common isolation of two or more inflorescences of various plants.
- 3) Free pollination (for comparison with the self-pollinised and cross-pollinised inflorescences) on plants flowering freely without being subject to any outside influence.

PLANT  
BREEDING

For the Leguminosae the methods used were :

- 1) Natural self-pollination (properly speaking).
- 2) Artificial self-pollination with pollen : a) of the same flower (self-pollination properly speaking); b) of another flower of the same inflorescence (pollination by the neighbour, "geitonogamy"); c) of another inflorescence of the same plant (also pollination by the neighbour).
- 3) Artificial cross-pollination (artificial pollination by the pollen of another plant), and, for *Lotus corniculatus*;
- 4) Artificial hybrid pollination by the pollen of a plant of another principal type.

The flowering and fertilisation conditions of each of the above-mentioned Gramineae and Leguminosae are studied, and tables are given of : 1) the results of the pollination experiments ; 2) the number of inflorescences removed ; 3) the total number of their flowers and seeds ; 4) the percentage of the average relation between flowers and seeds; 5) the average variations. In some of the tables concerning the Gramineae (for example, *Phleum pratense*, *Alopecurus pratensis*), the weight of the inflorescences and seeds during the different years of the experiment is also given. The table concerning *Lotus corniculatus* also includes the average length of the pods and the number of seeds either entirely or partly developed within them.

The results of the investigations are summarised as follows :

I. GRAMINEAE. — The results obtained from *Dactylis glomerata*, *Lotium perenne*, *L. italicum*, *Phleum pratense*, *Alopecurus pratensis*, agree with those of other workers, and confirm the supposition that these Gramineae are cross-fertilised species. Nevertheless, in the case of panicles tied up separately, and in that of two panicles of the same plant tied up together, higher figures were obtained for fructification, as much as 11.5 % of fruit being obtained in the first case and as much as 11.2 % of fruit in the second, according to the total number of flowers. Tying up panicles of different plants together always gave much higher figures.

*Dactylis glomerata*, *Phleum pratense*, and *Alopecurus pratensis* showed marked individual differences in their weak fecundity when self-pollinated or pollinated by a neighbouring plant.

In the case of *Poa fertilis* and *Bromus arvensis*, Gramineae whose flowering and fertilising conditions had not been previously studied, it was found that (contrary to that of the 6 above-mentioned Gramineae) almost normal fructification occurs both when the panicles are isolated and when many panicles of the same plant are tied up together.

II. LEGUMINOSAE. — In *Trifolium pratense* it was found that self-pollination, pollination with flowers of the same head, and pollination with flowers of another head of the same plant give such a slight fructification (if indeed it prove at all productive) that it must be attributed to chance circumstances.

On the other hand, *Medicago sativa*, when pollinated artificially or naturally, gave a better fructification than that claimed for it by other workers.

*Lotus corniculatus* proved very slightly susceptible to self-fertilisation by natural or artificial pollination in the heart of the same flower.



Good fructification was obtained with *Medicago lupulina* with inflorescences tied up separately and plants tied up in the same way. KIRCHNER's statement that the perennial form is less fertile than the annual form was, however, not confirmed.

806 - Selection of Spring Wheat in Sweden. — NILSSON-EHLE, H., in *Sveriges Utsäde-förenings Tidskrift*, Year 28, Pt. 2, pp. 51-76. Malmö, 1917.

Until recent years it was thought that there existed a negative correlation between earliness and yield, the one diminishing as the other increased. Results obtained lately with winter wheats show that these two characters develop, and are transmitted, independently of each other, at least up to a certain point.

In the northern climates, especially in Scandinavia, it is important to have wheats which combine the 2 characters "earliness" and "productivity". The selection and hybridisation experiments carried out at the Svalöf Station (Sweden) and at its branches, aimed at creating types of spring wheat which should be both very early and very productive. The results obtained from these experiments from 1911 to 1916 are given below:

1) Variety "0840-0841 Svalöfs Extra Kolben" — "Kolben" × "0201". The varieties "Värpär" and "0201" are obtained, by individual selection, from "Emma" wheat. The second variety is more productive than the first (12 % more in 1907), but is not of practical use because of the bad quality of its grain (angular and badly formed, weighing relatively little per bushel). In order to unite in one type the productivity of "0201" and the earliness and good quality grains of "Kolben", these two varieties were crossed. From the many hybrids was isolated the line 0840-0841, now called "Svalöfs Extra Kolben", and which is highly valuable from every point of view. From 1911 to 1916 a series of comparative cultural experiments was carried out at Svalöf with this wheat; the results are given in the following table:

*Results of comparative cultural experiments at Svalöf from 1911 to 1916.*

Variety	1911	1912	1913	1914	1915	1916	Average	Relative Index
<i>Yield of grain in cwt. per acre.</i>								
0840-0841 Extra Kolben . . . .	24.92	22.70	26.98	17.04	25.88	21.26	23.25	114
0201 . . . . .	22.14	18.08	28.26	16.23	26.28	19.51	21.82	107
Svalöfs Kolben . . . . .	22.40	18.08	23.32	8.62	22.06	20.86	20.47	100
Värpär . . . . .	22.92	17.20	23.96	16.64	25.96	20.31	21.18	104
<i>Weight in lbs. per bushel.</i>								
0840-0841 Extra Kolben . . . .	—	59.22	63.78	65.95	62.98	59.94	62.34	—
0201 . . . . .	—	57.21	62.74	63.06	60.82	56.65	60.10	—
Svalöfs Kolben . . . . .	—	60.42	63.70	66.11	62.02	59.94	62.50	—
<i>Weight in ounces of 1000 grains.</i>								
0840-0841 Extra Kolben . . . .	1.283	1.297	1.364	1.156	1.046	1.079	1.206	—
0201 . . . . .	1.552	1.403	1.687	1.286	1.361	1.361	1.447	—
Svalöfs Kolben . . . . .	1.213	1.202	1.305	1.156	1.002	1.079	1.159	—



In all years, whether cold and late as 1912 and 1916, or warm with an early spring as 1911 and 1914, the new variety always exceeded even "0201" in yield. This was certainly due to its greater earliness, for, in the years 1913 and 1915, when climatic conditions were particularly favourable (and when, consequently, great earliness was not required), the variety "0201" gave a yield about equal to that of the variety "0840-0841 Extra Kolben". In the cultural experiments at Malmöhus this last variety gave the following comparative results.

Variety	Yield of grain in cwt. per acre	Relative Index
0840—0841 Extra Kolben . . . . .	25.72	114
Vårpärl . . . . .	22.62	100
Svalöfs Kolben . . . . .	22.54	100

It is thus seen that the new variety surpassed the other two by 14 %. Outside Scania, in Östergötland, Halland and Uppland, it also gave very promising results.

Variety	Yield of grain in cwt. per acre	Relative Index
0840—0841 Extra Kolben . . . . .	17.68	112
Vårpärl . . . . .	—	104
Svalöfs Kolben . . . . .	15.87	100

The following characteristics may be noted: — 1) Strength of culm as in "Svalöfs Kolben"; 2) Earliness equal to this variety, for, during the 6 years 1911-1916, the "0840-0841 Extra Kolben" variety was only one day later than "Svalöfs Kolben" in earing and 1 ½ days later in ripening, 3) Quality of grain excellent, weighing as much per bushel as Svalöfs Kolben" and more than "0201"; moreover its small size (see weight per 1000 grains) allows a great saving in sowing without affecting the yield. The new variety "0840 - 0841 Extra Kolben" gives the following combination scheme with regard to the characters of the parents "0201" and "Svalöfs Kolben":

	0201	0840-0841 Extra Kolben	Svalöfs Kolben
Yield in grain . . . . .	+	(+)	—
Earliness . . . . .	—	(+)	+
Weight per bushel . . . . .	—	+	+
Size of grain . . . . .	—	+	+
Resistance of culms . . . . .	—	+	+

This new variety, which so advantageously unites the best characters of the two parents while eliminating the negative characters, will be put on the market in 1918 and may be used with assured success in all districts where "Svalöfs Kolben" is grown: Skåne, Halland, Gotland, Östergötland, Västergötland. Its yield, exceeding by 14 % that of "Svalöfs Kol-

ben" so far considered the most productive wheat, gives it, in selection, a degree of success never hitherto attained.

2) Variety "0804 Svalöfs Vårsquarehead" = "Varparl" × "0201". — By crossing "Värpäl" with "0201" many hybrids were obtained, There was a marked absence of uniformity and it was only with great difficulty that a variety — "0804" — which could be advantageously used, was isolated. It gave the following comparative yields :

Variety	Yield in grain in cwt. per acre	Relative Index
0804 . . . . .	23.73	108
Värpäl . . . . .	22.38	102
Svalöfs Kolben . . . . .	21.90	100

In grain yield, then, the variety "0804" is slightly inferior to the variety "Extra Kolben" (see above), but it is distinguished by the elasticity and strength of its culms (resistance to lodging), which make it suitable to very deep soils very rich in humus.

3) Variety "0880" — "Dalavårhvetet" × "Svalöfs Kolben". — The "Kolben" and "Extra Kolben" varieties are too late for central Sweden. In order to obtain a spring wheat adapted to this district, "Kolben" wheat was crossed with the "Dalavårhvetet" native wheat so as to unite in one plant the earliness of the one variety with the resistance to rust characteristic of the other. The line "0880" is derived from this crossing and appears to fulfill the desired requirements. It gave the following comparative yields (2 series of experiments) :

Variety	Yield of grain in cwt. per acre		Relative Index	
	I	II	I	II
0880 . . . . .	19.35	18.87	108	109
Kolben . . . . .	18.00	17.76	100	103
Dalavårhvetet . . . . .	—	17.28	—	100

The following other characters of the new variety may be noted : —

1) It ripens 4 days earlier than "Kolben", but 1 day later than "Dalavårhvetet"; 2) Straw as strong and as resistant as that of "Kolben"; 3) Resists rust well. It shows the following combination scheme with regard to the characters of the parents :

	Kolben	0880	Dalavårhvetet
Productivity . . . . .	+	+	—
Earliness . . . . .	—	(+)	+
Resistance to rust . . . . .	+	(+)	—
Resistance of culms . . . . .	+	+	—

"0880" is, therefore a valuable new variety for central Sweden, more especially so if the work now in progress allows the weight per bushel to be increased.

The experiments described all gave positive results. The other experiments may be summarised as follows:

4) "*Schlanstedter*"  $\times$  "*Vårpärl*" cross carried out to unite the productivity of this German spring wheat with the earliness of "*Vårpärl*" wheat.

5) *Interesting series of crossings between "Sol" autumn wheats and "Kolben" spring wheats.* The  $F_1$  hybrids have the character of spring wheat. In the  $F_2$  generation  $\frac{1}{4}$  of the hybrids have the character of autumn wheat and  $\frac{3}{4}$  the character of spring wheat. In the following generations  $\frac{1}{4}$  of the latter preserve and transmit the spring wheat character while  $\frac{3}{4}$  continue to break up into spring and autumn types in the simple Mendelian ratio of 3 : 1.

6) *Cross between "Extra Kolben" and "Halländskavårhvete" (Native Halland spring wheat).* Although the varieties obtained up to the present unite in satisfactory proportions and with equally satisfactory results the characters "productivity" and "earliness", it is not impossible to obtain subsequent improvements. This is the result aimed at with this crossing: the "Extra Kolben" variety already surpasses the "Kolben" variety by 14 % in yield of grain; if it were possible, by a new cross, to bring this up to 20-25 %, the position of spring wheats in Swedish rural economy would be very greatly improved.

807 - **Hybridisation Tests between Spelt and Wheat in Holland.** — GMELIN, H. MAYER, in *Cultura*, Year 29, No. 345, pp. 140-158, 2 plates. Wageningen, May 1917.

Common wheat (*Triticum sativum tenax vulgare*) and spelt wheat (*Triticum sativum Spelta*) are two varieties of *Triticum* showing such great anatomical and morphological differences that, till lately, they were considered two distinct species: *Triticum vulgare* (wheat) and *Triticum Spelta* (Spelt). The lack of affinity between these two varieties gives a particular interest to all hybridisation experiments. On the other hand, the attempt to unite in one and the same type the productivity of the best wheats with the resistance to cold of spelt may lead to practical results very useful to the development of the cultivation of cereals in Holland. The experiments were begun while the author was studying under GILTAY, interrupted, and taken up again in 1907 at the Agricultural Institute of Wageningen. Beardless, red glumed spelt ("roode ongebaarde spelt") was chiefly used, and "Essex" hairy-glumed wheat ("fluweelkaf Essectarwe").

The spelt has the following characteristics: 1) long ears with spikelets far apart; 2) smooth red glumes; 3) red caryopses; 4) inflorescence axis very slender, breaking when threshed. The characters of Essex wheat are: 1) long ears with spikelets close together; 2) white glumes covered with hairs; 3) white caryopses; 4) inflorescence axis strong and elastic. The  $F_1$  hybrids showed: 1) red glumes covered with hairs; 2) coloured caryopses, 3) thickness of spikelets intermediary to that of the two parents.

During the tests the plants to be hybridised were grown in pure lines, and all technical precautions (wide sowing, tying up of the inflorescence, etc.) were taken to avoid the apparition or intrusion of impure or new characters. In 1916 a very careful Mendelian analysis of the  $F_2$  generation was made, the colour of the glumes and caryopses, the presence or absence of hairs



on the glumes studied, and certain conclusions drawn with regard to the transmission of the character "density of spikelets". The  $F_2$  plants were derived from 3 different hybridisations and formed a total of 4189 plants divided as follows:

Hybridisation	Number of plants in $F_2$
I. — Red beardless spelt, plant No. 1 $\times$ Essex, plant No. 1 . . .	1341
II. — Essex, plant No. 2 $\times$ Red beardless spelt, plant No. 3 . . .	1409
III. — Essex, plant No. 3 $\times$ Red beardless spelt, plant No. 2 . .	1439

The presence or absence of hairs on the glumes and the colour of the glumes and caryopses (white or red) allow the hybrids of  $F_2$  to be distinguished and grouped fairly easily. In doubtful cases, which sometimes occur in determining the colour, the plant examined is not included in the calculation.

Table I summarises the results of the Mendelian analysis. These results are afterwards discussed.

TABLE I. — *Results of Mendelian analysis of  $F_2$ .*

	Number of plants in $F_2$	Plants with hairy glumes	Plants with smooth glumes	Plants with red glumes	Plants with white glumes	Plants with red caryopses	Plants with white caryopses	Plants with glumes of doubtful colour
I . . . . .	1 341	989	352	1 007	334	1 324	17	140
II . . . . .	1 409	1 042	367	1 146	263	1 388	21	135
III . . . . .	1 439	1 075	364	1 153	286	1 402	27	148
Total	4 189	3 106	1 083	3 306	883	4 114	65	423

1) *Hairy glumes (FF) and smooth glumes (ff).* — Table II, which gives the number of plants of each of these two types, shows a very satisfactory agreement between the numbers found and the numbers calculated. There is evidently a ratio 3 : 1 between these types, showing that it is a question of mono-hybridism with dominance of the character "hairy glumes".

If F represents the genetic factor determining the presence of hairs, and f the factor determining the absence of hairs, Essex wheat may be represented by the formula FF, spelt by ff, and their hybrid of the 1st. generation by the gametic formula Ff. This hybrid produces two kinds of sexual cells, F and f which, in the 2nd. generation, may form the following 4 groups: — FF, Ff, fF, ff; in other words, in the 2nd. generation there will be  $\frac{3}{4}$  hairy glumed plants and  $\frac{1}{4}$  smooth glumed plants.

2) *Red glumes (BB) and white glumes (bb).* — As in the preceding case, the ratio between these two types is 3 : 1, and the number of plants found agrees well with the number calculated.

TABLE II. — *Hairy glumed and smooth glumed plants in  $F_2$ . Comparison between the numbers found and the numbers calculated.*

	Numbers found		Numbers calculated	
	Hairy glumed plants	Smooth glumed plants	Hairy glumed plants	Smooth glumed plants
I . . . . .	989	352	1 005.75	335.25
II . . . . .	1 042	367	1 056.75	352.25
III . . . . .	1 075	364	1 079.25	359.75
Total	3 106	1 083	3 141.75	1 047.25

3) *Red caryopses and white caryopses.* — In the  $F_2$  the ratio between plants with red caryopses and those with white caryopses is 63 : 1, corresponding to a tri-hybrid. The difference in colour between red spelt and Essex wheat is, therefore, due to 3 distinct Mendelian unities  $R_1$ ,  $R_2$ ,  $R_3$  — of which one alone suffices to determine the red colour. Spelt may, then, be represented by the formula  $R_1R_1 R_2R_2 R_3R_3$ , wheat by  $r_1r_1 r_2r_2 r_3r_3$ , and the hybrid of the 1st. generation by  $R_1r_1 R_2r_2 R_3r_3$ . This hybrid produces 8 different sorts of sexual cells :  $R_1 R_2 R_3$ ;  $R_1 R_2 r_3$ ;  $R_1 r_2 R_3$ ;  $R_1 r_2 r_3$ ;  $r_1 R_2 R_3$ ;  $r_1 R_2 r_3$ ;  $r_1 r_2 R_3$ ;  $r_1 r_2 r_3$ , so that, in the 2nd. generation, there are 64 possible combinations, of which one only,  $r_1r_2r_3 \times r_1r_2r_3$ , has white caryopses. The ratio between plants with red caryopses and those with white caryopses is, therefore, 63 : 1.

4) *Density of the spikelets.* — The author has so far been unable to obtain analytical data as exact as in the preceding cases. Nevertheless, some of his conclusions are worthy of note because they contradict in part the hypotheses hitherto put forward on this subject. Spelt has long ears with few grains, Essex wheat, relatively short, compact ears, whereas the  $F_1$  hybrids show characters intermediary to these two. In the  $F_2$  are found; plants of intermediary character, plants with the characters of the parents, and finally, a fact which is both interesting and remarkable, *stable forms with ears still more compact than those of Essex wheat.* In another set of experiments the author also obtained forms with compact ears by crossing spelt with "Gelder I" wheat with lax ears.

These results suggest the following considerations :

a) According to NILSSON-EHLE, the character "*compactum*" is due to the presence of a factor  $C$  which determines the shortness of the internodes. This factor predominates over those of length -  $L_1 L_2$  — which it dominates absolutely, so that a plant with the formula  $CC L_1L_1 L_2L_2$ , and a plant with the formula  $CC l_1l_1 l_2l_2$  will always have an equal quantity of compact ears. According to NILSSON-EHLE this factor will always be found only in types with compact ears, never in the others, whereas the author obtained forms

with compact ears by hybridising beardless red spelt with "Gelder I" wheat, both with lax ears.

b) According to NILSSON-EHLE, the factor **C** is purely inhibitory and negative, and the only action it exerts is to prevent the other factors from showing their effects. How then is it possible, in the 3rd generation ( $F_3$ ) to explain the appearance of plants with ears much more compact than those of Essex wheat? In this case, on the contrary, the factor **C** seems to exert a directly determinative, positive action.

808 — **Experiments in Hybridizing Wheat and Rye in the United States.** — I. LEIGHTY, C. E. Carman's Wheat-Rye Hybrids, in *The Journal of Heredity*, Vol. VII, No. 9, pp. 420-427, 5 fig. Washington, September, 1916. — II. McFADDEN, EDGAR A., Wheat-Rye Hybrids, *Ibid.*, Vol. VIII, No. 7, pp. 335-336, 1 fig. Washington, July 1917.

I. — It appears that the first cross between wheat and rye was effected by A. S. WILSON of Edinburgh (Scotland) who presented his results, April 8, 1875, in a communication to the Botanical Society of Edinburgh, without however giving any illustration of the hybrids obtained. The plants were sterile, so the hybrid was not carried further than the first generation.

About 1877, E. S. CARMAN turned his attention to improving wheats: 1) by selection; 2) by changing spring into winter wheats; 3) by crossing; 4) by hybridizing wheat and rye. He seems not to have known of Mr. WILSON's work.

In the *Rural New Yorker* of August 30, 1884 is shown what is probably the first illustration ever published of a hybrid between wheat and rye secured by CARMAN. This hybrid produced a few seeds from which experimentation was continued and from the progeny of which a variety was produced and disseminated. A head of Armstrong wheat, a beardless variety known as Landreth, and now called Martin Amber, was selected for the female parent. In this head, 10 more or less imperfect kernels formed. Of these, 9 germinated. Although the resulting plants differed from one another in awn length, the colour of the glumes and of the straw, 8 of them showed only wheat characters without any trace of rye. For this reason, the writer is of opinion that CARMAN was mistaken in regarding them as hybrids. The ninth plant obtained, and which is given in the above-mentioned figure, is on the other hand, clearly a hybrid of wheat and rye. This is shown by the shape and general appearance of the head, the arrangement and number of spikelets, the glume characters and the culm. The latter resembled that of rye except in colour, having the whitish down near the head which never appears in wheat. This plant bore 10 heads which produced but 19 kernels, thus being nearly sterile. From these seeds, however, 14 plants were obtained, these produced altogether 107 heads (from 2 to 13 per plant) and showed great variability. Rejecting all inferior heads, enough grain was saved from the best to plant a plot of  $\frac{1}{20}$  (or  $\frac{1}{30}$ ) acre. The new crop varied remarkably and was entirely different from either wheat or rye. Heads 7 inches long were not uncommon and some bore compound spikelets. Other heads were scarcely 2 inches long. CARMAN continued his experiments: he tried to fix selections from the wheat-rye hybrids until 1892, at which date he introduced 3 new varieties: Nos. 1, 4 and 52; the two



first were considered as wheat  $\times$  rye hybrids, and the last as a pure wheat cross. From the data given, it cannot be ascertained whether the two first were actually descended from the true wheat-rye hybrid. In 1894, two further introductions of wheat varieties were made, No. 57 and No. 6. The first did not originate as a cross with rye, but the latter is a true rye-wheat hybrid and a variety of it bearing the name of Rural New Yorker No. 6 is now included among the wheat varieties of several experiment stations of the United States.

CARMAN continued the crossing of the wheat-rye hybrids with rye for 2 successive generations; one head,  $F_1$  pollinated with rye pollen in 1885 gave, under a form  $F_2$ , 17 kernels which resulted in 14 plants. These were nearly all sterile and the  $F_3$  was completely sterile, which put an end to the work.

These experiments therefore show that crossing wheat and rye is possible, but difficult; that the hybrids show great variability, characters appearing which are not present in either of the parents; that the 2nd. cross with rye is almost sterile, and the 3rd. cross completely barren.

II. — During the last 3 years, the writer has been engaged in work much resembling that of CARMAN. He aimed at obtaining a winter wheat which could resist the severe frosts of Dakota. He thus chose the most resistant types of wheat and rye, the Turkey and Swedish varieties. 9 heads of the former, on being pollinated with pollen from the latter, only produced 9 kernels, a maximum of 3 per head. Two only germinated, and produced a wheat plant, the other gave rise to a true hybrid though much resembling wheat. In culm length and the number of spikelets per head, the hybrid was intermediate between its 2 parents. It was remarkably vigorous. The first heads it formed had anthers without pollen. Some of the later-formed heads were pollinated with pollen from the Kharkow variety of winter wheat and 3 kernels were thereby obtained. These produced 2 plants but they died during the winter 1916-17 which was exceptionally severe. The writer intends continuing his experiments. The figure given in this article shows very clearly that the hybrid head is intermediate between those of its parents.

809 — **Experiments on the Artificial Hybridisation of Rice in Java.** — KOCK, L., in *Teysmannia*, Year 27, Pt. 9 and 10, pp. 502-519. Batavia, 1916.

The advantages of selection by hybridisation are first summarised in an introduction, then the results obtained by applying this method to rice, at Buitenzorg (Java), are described.

Among the varieties of rice cultivated in this district are: — “Karang Serang”, a native of Carolina, characterised by its earliness and the good quality of its grain (heavy and bulky), and “Skrivimankotti”, a native of Suriman, well-known for its high yields. In 1907, VAN DER STOK undertook hybridisation experiments with these two varieties in order to unite in one and the same type the productivity of “Skrivimankotti” and the high quality grain characteristic of “Karang Serang”. Selection from the hybrids of the 2nd. generation ( $F_2$ ) was begun by isolating those plants which best corresponded to the type aimed at in order to derive new lines from

them. At the beginning the results of these experiments were not very satisfactory owing to the heterogeneity and lack of stability among the progeny. This may, perhaps, be explained by the co-existence of *many* determinants for *one* character, which tend to diminish the number of and the opportunities for combinations showing the value. A further proof of this is the appearance in the hybrids of new characters found in neither of the parents, as, for example, black or pink awns, whereas "Karang Serang" has white awns and "Skrivimankotti" none at all.

It was only from 1913 onwards that some of the hybrids of the "Skrivimankotti" type began to show a certain uniformity and stability, an obvious sign that hymozygosis had been reached, at least for certain characters.

Below are given, for some of the hybrids obtained; 1) the weight per grain; 2) the yield of paddy per acre. The corresponding figures for the stock-plant "Skrivimankotti" are also given.

	Weight per grain	Yield of paddy per acre
	mgr.	tons
Stock plant "Skrivimankotti" . . . . .	31.05	1.80
Hybrid No. 1 . . . . .	30.01	2.09
Hybrid No. 2 . . . . .	34.74	1.94
Hybrid No. 3 . . . . .	34.46	1.89
Hybrid No. 4 . . . . .	33.01	1.97

These hybrids, which surpass "Skrivimankotti" both in the quality of their grain and in yield, correspond fairly well to the desired end. The "Karang Serang" variety is still superior with regard to the weight per grain (37.23 mgr.), but it is quite possible that by selection and hybridisation still better gametic combinations may be obtained.

The most efficacious method of hybridisation is as follows: — cut 'he top of the glumes with scissors a few hours before flowering, then remove the anthers with a fine needle, pollinate a few hours after with the pollen of another plant. It is not necessary to reclose the hybridised flowers, but the panicles are enclosed in a gauze envelope, which is protected at night and during rain by a little cover of dry leaves.

By this method the author, in one case, obtained 43.3 % of successes. On the other hand, the results were sometimes less good, or even negative, given the difficulties inherent to this method of hybridisation, and were largely dependent on the condition of the pollen at the time of pollination.

810 — Experiments with Small Grains (Wheat, Barley and Oats) Under Irrigation in Idaho, United States. — WELCH, J. S., in *University of Idaho Agricultural Experiment Station, Gooding Sub-Station, Bulletin* 93, 24 pp. Moscow, Idaho, January 1917.

In 1909, the Office of Irrigation Investigations of the United States Department of Agriculture and the Idaho Experiment Station established the Gooding Sub-Stat on for experimental work in the irrigation of farm crops. The Station is a tract of 40 acres located 2 miles south of the town of Gooding on the great Snake river plains at an elevation of approximately 3600 ft. The Bulletin analysed is based upon the results of

CEREALS  
AND PULSE  
CROPS



experiments conducted at this Station during the years 1909 to 1916 inclusive. The writer gives the following summary:

The small grain crops are of great importance on the irrigated farms of Idaho.

**WHEAT.** — Of all the spring varieties the soft white ones are best adapted for growth under irrigation. Dicklow is the leading variety grown under irrigation at this time. For average irrigation conditions, the durum wheats are not recommended.

In the irrigation of spring wheat, water can be used most efficiently in the early stages of the plants' development. If but one irrigation can be given, it should be applied just before the first jointing stage of growth. If water is withheld till the grain reaches the soft dough stage, it is of no value to the crop. The most satisfactory results were obtained at the Gooding Sub-Station by the application of one irrigation just before the first jointing and another between the first jointing and the blooming stage. In the growth of spring wheat it is not advisable to apply a total of more than one and one-fourth acre-feet of water per acre.

Winter wheats can be grown to advantage on irrigated lands; perhaps to best advantage in those sections where irrigation water is not plentiful. On the Station farm the best varieties have proved to be "Jones' Fife" and "Turkey Red". In the irrigation of winter wheat, one irrigation of slightly less than three-fourths of an acre-foot of water per acre, given just before heading was found to be sufficient. The average yields obtained at the sub-station by means of irrigation are given in Table I.

TABLE I. — *Performance Record of Irrigated Wheats.*

Name	Time from seeding to maturity in days	Average height of plants in inches	Yield per acre		Weight of grain in pounds per bushel
			Grain in bushels	Straw in tons	
Soft spring wheats:					
Marquis. . . . .	114	45	53.2	1.96	60
Dicklow. . . . .	117	47	46.1	1.86	59
College Hybrid No. 143 . . . .	114	43	43.8	1.74	62
Saskatchewan Fife. . . . .	114	43	41.6	1.86	59
Defiance. . . . .	117	46	39.4	1.89	60
Palouse Bluestem . . . . .	114	45	37.6	1.97	58
Galgals. . . . .	111	38	35.3	1.55	62
Spring wheats, durum type:					
Pelissier. . . . .	109	46	39.8	1.91	63
Kubanka . . . . .	109	47	38.3	1.91	63
Purple Durum. . . . .	109	45	32.2	1.98	64
Winter wheats:					
Jones' Fife . . . . .	272	45	53.6	1.78	62
Turkey Red. . . . .	275	45	52.4	1.88	64
Koffold . . . . .	276	49	42.8	1.57	61
Missouri Red Fulz. . . . .	272	55	40.5	2.06	61



TABLE II. — *Performance Record of Irrigated Barleys.*

Name	Grain per acre bushels	Straw per acre tons.
Trebi . . . . .	95.5	1.61
Beldi No. 1209* . . . . .	87.3	1.46
Sandrel . . . . .	82.9	1.46
Bohemian . . . . .	84.21	1.69
Horn . . . . .	81.65	1.94

\* Centgener numbers of the Californian Experiment Station where this variety and also No 1404 were originated.

**BARLEY.** — Of the six-rowed type Trebi, Beldi and Sandrel were the varieties which gave the highest crops under irrigation. The best varieties of the two-rowed type were "Bohemian" and "Horn". Eureka was the best of the hulless type.

For irrigating spring barleys about  $1\frac{1}{2}$  acre-feet of water should be applied per acre. Under normal irrigation winter varieties of barley are not nearly as productive as the spring-sown ones. Winter barley should be irrigated just before the appearance of the ears and only about  $\frac{1}{2}$  acre-foot of water applied per acre.

**OATS.** — A large number of the varieties of oats are very productive. The best from this point of view are Swedish Select with 96.6 bushels of grain per acre and 1.63 tons of straw per acre, and Wisconsin Pedigree No. 1 with 96.5 bushels of grain and 1.69 tons of straw per acre. Oats do not require more than  $1\frac{3}{4}$  acre-feet of water per acre.

811 — "**Kafir**" and "**Milo**" Sorghum as Grain Crops and Fodder Crops in Arid Soils Experiments made in the Argentine. — VILLALBA, ABRAHAM, in *Ministerio de Agricultura de la Nación, Dirección general de Enseñanza e Investigaciones agrícolas, Sección Enseñanza extensiva, Boletín* No. 46, pp. 32, 6 plates, Buenos-Aires, 1916.

With the exception of the most important varieties (*halepensis*, *saccharatum*, *scoparium*), the cultivation of sorghum as a fodder and grain crop is unknown in the Argentine. The author wished to test its suitability for the arid, dry-wind beaten districts of the southern part of the Republic. These districts are not suited to the cultivation of wheat or maize and are largely uncultivated. The experiments were carried out in various districts in collaboration with the farmers, and those made at Vilelas, in the centre of the Chaco of Santiago del Estero are specially described. Three varieties were used: 1) white kafir with black glumes; 2) "colorado", or red, Kafir; 3) yellow milo. They were all sown on maize stubble, the soil being prepared by two consecutive harrowings; a PLANET cultivator was used. The yields per acre were: — white kafir with black glumes, 28  $\frac{1}{2}$  cwt; red kafir, 29  $\frac{3}{4}$  cwt.; yellow milo, 39  $\frac{3}{4}$  cwt.

The milo ripened 8 to 10 days before the kafir and, in other districts as well, gave a higher yield than kafir.

The advantage of sorghum lies in its great vitality; if it be destroyed by the teeth of animals, locusts, or other causes, it produces new shoots and still yields a harvest. Moreover, the grain ripens before the culm, and when

it is harvested there remains an excellent and abundant yield of fodder. By sowing sorghum early, that is to say, in August or in September, one or two crops of green fodder and one or two crops of grain are obtained, according to whether, at the first harvest, the culms are cut low. Sorghum is very sensitive to frost. It does not encroach on the land and has very few enemies, the most harmful of which are birds.

The cultivation of non-sugar sorghum in the arid soils of the Argentine is strongly advised for the following reasons :

1) The above-mentioned varieties are more resistant to drought and hot winds than either maize or wheat ;

2) Their cost price is less and their yield greater than those of maize or wheat. The following table is based on the average cost price and average unit yield for maize and wheat throughout the Republic, and for kafir in the Chaco Santiagueño :

*Cost Prices and Unit Yields of Wheat, Maize and Kafir.*

Expenses	Wheat		Maize		Kafir.	
	£.	s. d.	£.	s. d.	£.	s. d.
Preparation of the soil, sowing, cultivation, etc. . . . .	2.	4. 0	1. 15. 2		1. 15. 2	
Rent of ground . . . . .	0.	17. 7	1. 6. 4		0. 8. 9	
Threshing, sacks, transport . . . . .	1.	4. 7 <sup>1</sup> / <sub>2</sub>	1. 19. 6 <sup>1</sup> / <sub>2</sub>		2. 12. 9	
<i>Total expenses</i> . . . . .	4.	6. 2 %	5. 1. 3 %		4. 16. 9	
<i>Yield per acre</i> . . . . .	5	1 <sup>1</sup> / <sub>2</sub> cwt.	12 cwt.		24 cwt.	

3) The food value of kafir flour is equal to that of wheat flour as the following table shows :

*Analyses of kafir and wheat flours.*

	Kafir flour	Flour of Santa-Fé Wheat
Moisture. . . . .	12.06 %	14.10 %
Nitrogen. . . . .	9.52	12.60
Fat. . . . .	1.55	1.60
Fibre . . . . .	2.60	0.60
Starch. . . . .	73.47	70.50
Ash . . . . .	0.80	0.60

In starch value kafir is inferior to one cereal only -- rice.

4) Sorghum replaces maize very effectively as a food for human beings, domestic animals and poultry.

5) In pig-breeding sorghum offers great possibilities on account of :

1) cheap land (in the arid or semi-arid region of the Argentine ; 2) high yield in grain; 3) low cost price.

6) The culms form an important supplement to green fodder ; sometimes 2 crops of fodder and 2 crops of grain may be obtained per annum.

812—**Shallu, a Variety of Sorghum, in the Great Plains, United States.** — ROTHGEB, BENTON E., in *Farmer's Bulletin* 827, *United States Department of Agriculture*, 8 pp., 3 fig Washington, D. C., June 1917.

Many varieties of sorghum have been introduced into the United States in the past 30 or 40 years ; some of them have proved valuable under dry-land conditions in the southern Great Plains. Large, late varieties generally cannot be depended upon for grain production in this section, because of the short and often partly unfavourable growing season, Early and mid-season varieties of dwarf or medium growth such as the early varieties, milo, feterita and kafir give the best results. Shallu is not adapted to dry-land conditions, as it requires a long favourable season to mature. This is shown in the Bulletin analysed which sets forth the results obtained with Shallu in comparison with other varieties in varietal tests carried out at Texas, Oklahoma, Kansas and New Mexico.

Shallu was imported from India into the United States under the name "Egyptian Wheat" by the Louisiana Agricultural Experiment Station about 1890. Since then it has been distributed rather widely, particularly in the southern Great Plains.

It requires from 125 to 140 days to mature, and because of its late maturity is more likely to be injured by drought than the early varieties of kafir and milo. The large open heads are attractive and give the appearance of producing high yields, but, in reality, under the most favourable dry-land conditions, the yields are lower than those of kafir and milo, and in unfavourable years, shallu often fails entirely. In addition, the stalks are slender and easily blown down by storms, making the crop difficult to harvest. Because of its late maturity, shallu is more exposed to the attacks of the Sorghum midge (*Contarinia sorghicola* Coq.).

Experiments with shallu have been conducted at the Cereal Field Station, Amarillo, Tex., since 1905. This station has an elevation of about 3 600 ft. and an average rainfall of about 21 inches.

The average yields obtained there during the period from 1911 to 1916 were ; Shallu 10 bushels ; Dwarf milo 27.4 bushels ; feterita 21.8 bushels and dwarf kafir, 19.3 bushels per acre.

At the Woodward Field Station at an elevation of about 1900 ft., and with an annual rainfall of about 24 inches, the average yield during the three years 1914-1916 was : Shallu 12.5 bushels ; Dwarf milo 21 bushels ; feterita 15.4 bushels and Dwarf kafir 20 bushels per acre.



813 - Experiments with Irrigated Legume Crops and Grass Pastures. — WELCH, J. S., I. Experiments with Legume Crops Under Irrigation, in *University of Idaho Agricultural Experiment Station, Gooding Sub-station Bulletin* No. 94, 14 pp. 4 fig. Moscow, Idaho, January 1917; II. The Management of Irrigated Grass Pastures, *Ibid.*, *Bulletin* No. 95, 17 pp. 3 fig. Moscow, Idaho, January 1917.

I. The legume crops are among the most important for the irrigated lands of Southern Idaho. The principal leguminous plants grown are: lucerne and clovers, upon which an extensive and growing livestock industry is based; clover seed, peas and beans (field peas are used in pork production). The use of all these crops in upbuilding and maintaining the fertility of the soil of this region has become one of the first principles of agricultural practice in the State. The work which has been conducted at the Gooding Sub-Station with the legume crops has consisted of the testing and comparison of varieties, experiments upon various phases of irrigation practice, and the seeding and cultural management of the most important of these crops. In the irrigation experiments, all water, both on-flow and run-off was carefully measured, all waste water being deducted from the amount supplied.

*LUCERNE. Varieties.* — During the season of 1910, 11 varieties of lucerne were grown. Very irregular stands were secured, and therefore no data were obtained on the relative yields of the different varieties. The "common" lucerne, which is by far the most extensively grown in Idaho, usually consists of several varieties or strains.

*Seeding.* — Under ordinary conditions, it was found by experiments that the best results came from sowing 12 pounds per acre. Heavier seedings produced thicker stands, while the seedlings were shorter and less coarse and came into bloom on an average 3 days later than those grown from the lighter seedings. Only 2 cuttings were taken; a better quality of hay was produced by the 12, 16 and 20 pound seedings than by the 4 and 8 pound seedings. Under ordinary conditions, with a properly prepared seed bed, and a sufficient moisture supply, it is waste of seed to use more than 12 pounds per acre. The best results were secured by sowing lucerne with a drill.

*Irrigation.* — During the seasons of 1910 and 1912, experiments were made with a view of comparing the relative value of the corrugation and the flooding methods for the early irrigation of lucerne. On the plots that were irrigated by the corrugation method the furrows were 30 inches apart. The sowing was done on relatively dry soil and irrigated afterwards. Observations made on this test indicate clearly the superiority of the corrugation method of starting lucerne, as it prevents soil-baking, but later it shows little advantage over the flooding method. On sandy soils and steeper slopes, however, the former system may still be valuable to prevent washing and to aid in an even distribution of the irrigation water.

The results of this work show that comparatively deep irrigations should be used for lucerne. Under conditions similar to those prevailing at Gooding, the lucerne should receive from  $\frac{1}{2}$  to  $\frac{3}{4}$  acre-foot per acre in order to secure 3 crops of hay per season. This amount of water can be applied

best in 7 or 8 irrigations. More water than the quantity indicated may produce a little more hay, but the increased yield will not justify the extra expense involved.

*Seed production.* — In general, much less water is required to produce lucerne seed than lucerne hay. The best results are obtained by light frequent applications of water, because they tend to maintain a uniform soil moisture content. The best crop was obtained from rows 35 in. apart.

**CLOVERS.** — Common red clover is the kind most grown. As regards irrigation, the same system is adopted for clover hay production as for lucerne hay. When grown for seed it is advisable to clip the first growth late in May and afterwards to apply light irrigations. Red clover is an especially valuable crop for use in building up the fertility of new lands.

Alsike and white clover are particularly valuable in pasture mixtures. When grown for seed, the first growth should be allowed to mature the seed crop.

**PEAS.** — The conditions prevailing in south Idaho favour the production of field peas; the best varieties are: Amraoti, Blue Prussian, Kaiser, and Bangalia. The seeds should be sown at the rate of 90 to 100 pounds per acre. Early sowing is advisable. Under normal conditions, 2 irrigations give the best results. When mixed with oats, they make a satisfactory hay crop. They are extensively and profitably used in economical pork production in Idaho.

**VETCHES.** — *Vicia villosa*, or hairy vetch, is the most productive of the vetches. When grown with oats, it produces a heavy yield of excellent hay. The second growth can be used profitably as a green manure.

**FIELD BEANS.** — Of all the varieties tried, White Navy is the most satisfactory. Horse beans are valuable as a "hogging off" crop, but for this purpose they are not the equal of field peas.

The climatic conditions which prevail over many irrigated sections of south Idaho do not favour the production of soy beans and cow peas (*Vigna Catjang* or *Vigna sinensis*).

II. — During the last few years the interest in irrigated grass pastures has much increased in southern Idaho, where the conditions are well adapted to grass production. Of all the different grasses tested at the Gooding Experiment Station, the best varieties are: Orchard grass (*Dactylis glomerata*), Smooth Brome grass (*Bromus secalinus*), Kentucky blue grass (*Poa pratensis*), Meadow Fescue (*Festuca pratensis*), and Timothy. Mixtures give better results than any variety sown alone. Different conditions require different mixtures.

A total of 20 to 24 lbs. per acre is sown. Grasses can be sown at any time from early spring to the latter part of July; autumn sowing is not advisable. Broad-casting the different varieties separately is the most satisfactory method of sowing. Sowing should be done on well prepared land and the seed covered lightly. Under average conditions, a nurse crop should not be used. From planting, until the grass comes up, the seed bed must be kept moist. The corrugation method is the best for the first season's irrigation; afterwards flooding is very satisfactory. Established pastures should



be irrigated about every 12 days, the amount of water applied at the Gooding Sub-Station being about 2.25 acre-feet per season. Pastures can be grazed lightly the latter part of the first season. Grazing tests have shown that one acre of good grass will properly maintain 2 good dairy cows, or 3 beef steers, without any extra feed, from the end of April to the latter part of September. On an average, the steers gained in weight 732 pounds of beef per acre in one pasture season.

With regard to sheep, it was found that about 7 or 8 large ewes of the mutton breeds with their lambs can be properly maintained on 1 acre of irrigated pasture. It is advisable to divide the pasture into 2 or 3 parts.

814 — **Wild White Clover (*Trifolium repens*) for Artificial Grass Land ; Trials in Different Parts of the United Kingdom.** — *The Journal of the Board of Agriculture*, Vol. XXIV, No. 4, pp. 424-428. London, July 1917.

The experiments carried out in various parts of the United Kingdom by GILCHRIST, JENKIN, MERCIER, MALDEN, M'ALPINE, PORTER, VOELCKER (1) have definitively established the great value of wild white clover (*Trifolium repens*). It produces perennial plants and so gives better results than commercial white, or Dutch clover, which dies out more quickly. At Cockle Park (Northumberland County Agricultural Experiment Station), where extensive trials have been conducted, substantial benefits have been obtained from its use as early as the aftermath of the 1st. year's hay, and close, clovery herbage now continues to be produced from the plant up to the 11th. year after sowing.

It is a common experience that the inclusion of wild white clover in a seed mixture has established pastures of a high feeding value within 18 months after sowing, and has produced large crops of hay of high feeding value for some years in succession.

As regards manuring, the most satisfactory results have been obtained by applying 7 to 10 cwt. of high grade basic slag per acre in the autumn following sowing, after harvesting the cover crop. Dressings of dung or of nitrogenous manures develop the grassy herbage at the expense of the clovers, and therefore should not be used where it is desired to encourage wild white clover. On light soils known to respond to potash, a dressing

(1) GILCHRIST, DOUGLAS, A.: Wild White Clover, in *Farmers' and Stockbreeders Yearbook*, 1917. — Idem: Trials of Wild White Clover, in *Journal of Board of Agriculture*, Vol. XVI, No. 9, December 1909, and Vol. XXII, No 11, February 1916 — Idem: *Annual Guides to Cockle Park*, 1906-16. — JENKIN, T. J.: Ordinary White Clover Seed versus Wild White Clover Seed, in *Journal of the Board of Agriculture*, Vol. XXIII, No. 12, March 1917. — MERCIER, W. B.: Grass and Clover Seeds, in *College Bulletin*, No. 15, *Armstrong College, Newcastle-Upon-Tyne*. — MALDEN, W. J.: Harvesting White Clover, in the *Farmer and Stockbreeder*, Vol. XXIX, No. 1402, New Series, August 7, 1916. — M'ALPINE, A. N.: Wild White Clover, in *Transactions of the Highland and Agricultural Society of Scotland*, Series V, Vol. XXVII, 1915. — PORTER, JOHN: A Big Stride in Agricultural Improvement, in *The Hereford Times*, 1916. — VOELCKER, J. A.: A Report on Experiments Conducted in 1888 by Local Agricultural Societies in Conjunction with the Royal Agricultural Society, Saltney Experiments, in *Journal of the Royal Agricultural Society*, Vol. XXV, 1889.



of salt (about 4 cwt. per acre) or potash manure should be applied in addition. If the land is mown for hay a further dressing of 8 cwt. of high-grade slag per acre, or its equivalent of low-grade slag, should be applied every third year. If the land is pastured, 5 cwt. every third year is probably ample.

Wild clover is present to some extent on most pasture; it is also common on roadsides and on some types of hill-grazing. Most of the seed of this clover on the market at present is harvested on the Weald clay in the Counties of Kent, Surrey and Sussex. It has, however, also been successfully harvested in Gloucestershire and in many of the southern counties. Small lots have also been occasionally obtained from Wales and from Northumberland and other northern counties. The seed should be harvested only from fields that have been down to grass for many years.

Poor pastures with very little grass are usually selected to provide the seed. These should be dressed with about 7 cwt. per acre of basic slag in the autumn or early winter, and should be grazed over with cattle till the end of May in order to keep down the grass. The clover should then be fit for harvesting in August or September. Some growers treat it as an ordinary hay crop, but it should be handled gently and shaken as little as possible. The hay should be made into small cocks and care taken that it does not heat in the stack. To obtain commercially pure seed, it is necessary, after threshing, to use a special dressing machine. Farmers are generally satisfied with 2 to 3 cwt. per acre, although larger yields are not unknown.

"Once Grown" wild clover has given quite satisfactory results. It is produced from leys in which true wild white clover is the only clover used in the seed mixture. The seed is harvested when the white clover has fully established itself, that is to say, after 2 or 3 years. It is of the greatest importance that the ley should receive no nitrogenous manures, but a good dressing of basic slag (10 cwt. per acre) should be applied after the corn has been harvested. The "Once Grown" wild white clover should be harvested in the same manner as the wild white clover.

The field should be grazed until about the 1st. of June and the clover cut early in September. Some growers taken an early cutting of grass and clover hay about the middle of June. In this cutting, the grasses will preponderate, but the second crop will produce chiefly wild white clover. The mixture sown to produce the seed of the "Once grown" clover should consist of about 4 lbs. of wild white clover per acre and suitable grasses for a 4 years' ley.

The seed of wild white clover is, on an average, much smaller than that of commercial white clover. Further, samples frequently contain a large percentage of "hard" seed (10 per cent. or more). These can be made to germinate by rubbing them lightly, or shaking them in a box lined with glass paper. The seed of natural wild white clover differs from that of the "Once Grown" clover in the proportion of impurities it contains. These consist chiefly of bird's foot trefoil (*Lotus corniculatus*) up to 5 per cent. -- yellow suckling clover (*Trifolium filiforme*) up to 16 per cent. -- crested dog's

tail (*Cynosurus cristatus*) — bent (*Agrostis vulgaris*) and sometimes the meadow grasses with pasture seeds like tormentilla (*Potentilla tormentilla*), wood-rush (*Luzula* spp.) and self heal (*Prunella vulgaris*). "Once Grown," wild white clover usually contains the seeds of self heal (*Prunella vulgaris*) and rib grass (*Plantago lanceolata*) with impurities like *Geranium* spp., mad dog (*Rubia* spp.) and bladder campion (*Silene inflata*), so often associated with temporary leys; it sometimes also contains a high proportion of red clover seed.

## FIBRE CROPS

815 — **The Cultivation of Flax for Fibre in Canada.** — ADAMS, J., in *Dominion of Canada Department of Agriculture, Dominion Experimental Farms, Division of Botany, Bulletin No. 28*, 23 pp., 15 fig. Ottawa, 1916.

This bulletin was written for the use of practical agriculturists, and in order to promote the cultivation of flax in Canada, where it has already been grown successfully for a number of years in the Province of Ontario. In 1911, the area devoted to the crop in that province was 12 128 acres, but it decreased to 5334 acres in 1915. Flax has also been grown for fibre to some extent in the province of Quebec.

DR. W. SAUNDERS, Director of the Dominion Experimental Farms, has carried out a series of tests in growing flax for fibre in the different provinces of Canada and published an account of his work in Bulletin No. 59 of the above named institution in 1908. Dr. C. E. SAUNDERS has been engaged for a number of years in improving the varieties of flax by breeding from selected strains. Prof. C. A. ZAVITZ, of Ontario Agricultural College, Guelph, has experimented with a number of different varieties of flax in order to determine the best rate of sowing, and the yield per acre. He obtained the following results (averages 1905-9 inclusive):

Amount of seed sown (in pecks)	Height of crop (in inches)	Yield of Straw (in tons)	Yield of grain (in bushels)
1	29	1.55	14.9
2	29	1.68	15.2
3	29	1.96	18.6
8	28	2.24	19.9
12	27	2.35	20.2
16	26	2.24	18.0

Prof. ZAVITZ also carried on experiments with flax seed obtained from Ontario, Manitoba, Russia and Holland. His results (average) for the period 1905-11 were as follows:

Variety	Straw per acre tons	Grain per acre bushels
Manitoba	2.51	17.55
Ontario Common	2.54	16.42
Russian	2.32	14.99
Holland	2.31	14.94

The average weight of dry unthreshed flax straw for the province of Ontario is about 2 tons per acre. The average yields of flax seed per acre during the 5 years 1910-1915 were as follows:



Canada . . . . .	11.27	bushels
Quebec . . . . .	11.41	"
Ontario . . . . .	16.44	"
Manitoba . . . . .	12.18	"
Saskatchewan . . . . .	11.17	"
Alberta . . . . .	11.53	"

The crops, however, vary greatly in the same locality in different years.

816 - **Brazilian Piassava.** — TAVARES, J. S., in *Brotéria, Serie de Vulgarização Científica* Vol. XV, Pt. 4, pp. 149-153. Braga, July 1917.

In Brazil the name "piassava" or "piassaba" is given to the two palms *Attalea funifera* Mart. and *Leopoldinia piassaba* Wall., as well as to the fibre obtained from them. The first is a native of the coast of the southern part of the states of Spirito Santo, Alagoas, and particularly of Bahia, of the Nazareth district as far as Porto Seguro and Trancoso. The second is a native of Para and the Amazon district, where it covers large stretches of land, especially in the valleys of the Preto and Paduiry rivers and between the Marié and Curicuary rivers.

The fibre is obtained from the veins of the sheaths of the young leaves; when the leaf has left it, the sheath curves back over the stem and decomposes, leaving only the fibre which covers the stem. This fibre is dark in colour and of great strength, elasticity and resistance. The finer fibre is used for making cord, the coarser for brooms, mats, mattresses and baskets.

The piassava of the Amazon *Leopoldinia*, which is the finest of all, is used for making clothes brushes. Cord made from this fibre is very resistant to the corrosive action of sea-water. Each tree is capable of yielding about 4 to 6  $\frac{1}{2}$  lbs. of fibre per annum.

The Amazon piassava is much scarcer and much inferior in quality to that of Bahia. In both states the number of piassava palms is diminishing owing to bad harvesting. Thus, whereas, in 1890, 5604 metric tons of piassava were exported from Bahia, in 1900 only 1703 tons were exported.

Practically all the Brazilian piassava is exported from the ports of Bahia and Manaus; in 1914 there were exported from these two ports over 1753 tons, representing a value of 633 368 paper *milreis* (1).

The principal importing countries up to 1914 were: Great Britain, to whom about  $\frac{2}{3}$  of the exports went, Germany and Portugal. The exports to other countries are comparatively negligible.

Brazilian piassava already competes with that obtained in Africa from *Raphia vinifera*, and largely produced in the British African colonies, especially Sierra Leone. In 1914 this colony exported 999 metric tons, valued at 98 318 *milreis*.

Besides fibre, *Attalea funifera* also produces a stone fruit, from 8 to 10 cm. in diameter. The pulp is used for feeding pigs; the very hard kernels supply a sort of vegetable ivory and are used for making buttons, etc. In 1914 over 1634 tons of these kernels, valued at 113 609 paper *milreis*

(1) 1 paper *milreis* = 1s. 4d. at par.

(Ed).



were exported to Brazil. The only countries which import this product are France, who buys nearly all of it, Germany, Great Britain and Belgium.

These kernels are made to burn with difficulty, but, once alight, give out a great heat, and can replace coal.

On an average the trees produce 500 fruit per annum, and, as an average of 500 kernels go to a ton, 2 1/2 acres with 450 trees would supply 45 tons of fuel per annum. At present these kernels are only used in the Rio de Janeiro district.

PLANTS  
YIELDING OILS,  
DYES,  
TANNINS, ETC.

**817 - The Castor-Oil Plant in Egypt** (Note presented to the Official Commission of Agricultural Commerce). — MOSSERI, V., in *Bulletin de l'Union des Agriculteurs d'Egypte* Year 15, No. 118, pp. 1-29. Cairo, January-February 1917.

Although the castor-oil plant has been known in Egypt since very remote times, it is no longer put to any commercial use. This neglect is due to economical considerations. The current prices for the seeds of this plant are very high, but they must be considered as abnormal and unlikely to continue after the war. There is little likelihood that the cultivation of castor-oil will be started again in this country, unless it be on the banks of the irrigation dykes.

Owing to its root system castor-oil cannot be planted near other crops. It might be grown on the canal banks either for its seed or for the breeding of *Attacus cyynthia* (1), as is done in Hindoustan; in any case, preliminary tests are necessary before the chances of success of this new silkworm industry can be determined. For seed production, the castor oil plant needs well-drained, non-saline soil.

The weight of the seeds, their volume and the percentage of kernel and shell, are different in each variety, and for the same variety, according to the district, the season and the harvest. The physical properties of the soil seem to have only a secondary influence on these various factors, but an excess of water or salts in the soil decreases them all to a more or less notable extent, this decrease affecting the kernel and shell of the seed in almost identical proportions. Whereas the weight and volume are greatly affected by an excess of water or salts in the soil, the percentage of kernels and shells is affected to a much smaller extent.

The oil content depends especially on the atmospheric conditions which prevail during the formation and ripening of the seeds; it also varies with the variety, locality, season and harvest. Variations due to the physical properties of the soil are almost imperceptible. It is affected by an excess of water or salts, but to a smaller extent than the weight. In the same variety the richness in oil seems to increase if the plant is moved from the north to the south and decrease if it is moved from the south to the north. A high oil content seems to correspond to a heavy seed: this has, however, not yet been confirmed.

The ash content is much higher in seeds from the more or less salt soils from the north of the Delta (Bararis) than in those of the other districts

(1) More properly called *Attacus ricini*; in China *A. cyynthia* is bred on the *Ailanthus*. (Ed.)

examined, nevertheless in the Bararis, the difference in ash content in good soils and damp or salt soils is relatively insignificant.

The conclusions deduced from these investigations still require definite confirmation, and, by reason of the interest attached to it, the question deserves a closer study. To this end, seeds of a well specified variety should be sown in three districts — the north, centre and south of the country; the seeds from each district should in turn be sown in each of the two others, and the variations in weight and richness observed during several years.

818 — **Results of Experiments on the Preparation of Copra, in Java.** — SMITS, M. B., in *Teysmannia*, Year 27, Pt. 9 and 10, pp. 495-501. Batavia, 1916.

The yield in copra of coconuts collected on the coast of Sumatra, both when very ripe and when almost ripe, was studied. It was found that 500 very ripe nuts, weighing 844.35 kg. (1), gave 127.15 kg. of dried copra, whereas 500 almost ripe nuts, weighing 952.86 kg., gave 128.75 kg. of copra. The yield in copra is, therefore, almost equal. This is proved still more clearly by comparing the percentage of copra with the weight of the nuts separated from the fibre. It was then found that ripe fruit gave 23.5 % and almost ripe fruit 23.3 % of copra. There is, thus, no difference in yield obtained by picking very ripe or almost ripe fruit.

Comparisons between nuts picked near the coast and those picked further inland showed no notable difference.

Further the difference in yield of different varieties was studied, and it was found that the "kerambil sirah" variety was much superior in yield in copra and oil than the "kerambil idjau" variety, which is also very common in the island. This is illustrated by the following averages:

	Total weight		Weight in percent. of the weight of the non-decorticated fruit	
	Kerambil idjau	Kerambil sirah	Kerambil idjau	Kerambil sirah
Copra . . . . .	0.180 kg.	0.230 kg.	18.3 %	24.2 %
Oil . . . . .	0.097 kg.	0.128 kg.	9.9 %	13.4 %

819 — **Seeds of the Madagascar Physic-Nut Tree (*Jatropha Curcas*).** — See No. 853 of this Review.

(1) 1 kg. = 2.2 lbs.

(Ed.)



820 - **Study of the Sucrose Variations in Successive Cane Joints as They attain Maturity with Special Reference to the Death of the Leaves.** — VENKATARAMAN, T. S. and KRISHNAMURTI, ROW K., in *The Agricultural Journal of India*, *Special Indian Science Congress Number* 1917, pp. 117-126, Agricultural Research Institute, Pusa, 1917.

The sucrose value of any sugarcane seedling is ordinarily ascertainable only when the seedling is ripe and is harvested i. e. twenty months from the date of germination. An attempt was made at the Coimbatore Sugarcane Breeding Station to get an earlier indication of the sucrose value of a seedling, analysing the part of the cane which bears only dead leaves under the hypothesis that the death of the leaf corresponded to some definite process or cessation of process in the joint to which the leaf is attached. A series of fortnightly analyses of thick canes, thin canes and seedlings was instituted to test the value of this method of "dead leaf" analysis.

The series yielded a new method of ascertaining the ripeness of any variety or seedling. It was found that :

In a very immature cane the highest sucrose content is found in the lowest section. As the cane advances in maturity this region of the highest sucrose content gradually moves upwards. If different canes of the same variety are analysed on different dates, the highest sucrose contents obtained on these dates are practically identical. A cane left growing in the ground after it has attained maturity shows rapid deterioration at the basal points. The highest sucrose reading obtained by sectional analyses of any particular variety probably represents the highest sucrose content that the variety is capable of containing under the given conditions, and this the writers have called the "sucrose index" of the cane. It is claimed that this is fairly constant for each variety or seedling and will enable a comparison to be made between different seedlings, even when they are immature.

821 - **Effect of Sulphuric Acid Sprays on Sugar Beet: Experiments carried out at the Sugar Industry Experiment Station, Prague (Bohemia)** (1). — ANDRLIK, K., in *Zeitschrift für Zuckerindustrie in Böhmen*, Year 41, Pt. 10, pp. 685-688, Prague, July 1917.

The experiments described, carried out at Ouholičky (Bohemia), were undertaken to ascertain whether the addition of sulphuric acid is capable of replacing in the soil the nutritive elements contained therein in an unassimilable form by transforming them into compounds which can be utilised by plants. The experimental plant chosen was the sugar beet.

During the 1912 experiments the plots were 1 are (2) in area. One received 2 kg. of sulphuric acid at 50° Baumé, another a double quantity, and two others served as controls. The acid was diluted in 10 times its volume of water and applied with a hose. One of the untreated plots, and that treated with 2 kg. of sulphuric acid were attacked by insect pests; moreover, they were faulty, and at harvest time the produce was not entirely ripe. On the other plots growth was more vigorous and more regular. The same experiments were repeated in 1913. Germination was best on the plots treated with 4 kg. of sulphuric acid and the plants on it were

(1) Cf. R., 1916, Nov. 196. — (2) 1 are = 119.60 sq. yards.

(Ed.).



of a brighter green. The numerical results (given in appended tables), although of general value only, seem to prove that sulphuric acid did not increase the crop, but that it had no harmful effect on the sugar content or purity of the juice.

*Action of Sulphuric Acid on Sugar Beets.*

	Yield per acre		Sugar obtained by digestion in warm water	Composition of juice		
	Roots	Tops.		Saccharose	Polarisation	Quotient of purity
	tons	tons				
<i>1912 Experiments:</i>						
Controls (averages of 2 plots) . .	9.71	18.59	15.8%	19.6%	17.07	87.05
Spraying with 2 kg. per are of sulphuric acid . . . . .	7.84	14.41	15.0	19.0	16.25	85.5
Spraying with 4 kg. per are of sulphuric acid . . . . .	10.91	22.42	15.8	19.5	16.9	86.6
<i>1913 Experiments:</i>						
Controls . . . . .	13.61	11.50	18.0	21.45	19.57	91.2
Spraying with 2 kg. per are of sulphuric acid . . . . .	13.14	10.27	18.2	21.55	19.82	91.9
Spraying with 4 kg. per are of sulphuric acid . . . . .	12.50	10.11	18.4	21.90	20.10	91.8

822 - Experiments in Transplanting Coffee at the Porto Rico Agricultural Experiment Station. — McCLELLAND, T. B., in *Porto Rico Experiment Station Bulletin* No. 22, 11 pp. + 1 plate. Washington, June 29, 1917.

In Porto-Rico, the general practice in transplanting coffee has been to pull, or dig out without any adhering soil, a young tree several feet high with little care as to how many small roots were broken off, and to transplant with no leaf pruning.

In a previous publication, the Porto-Rico Experiment Station suggested the advisability of selecting seed from vigorous trees and making nurseries for the production of vigorous seedlings.

The object of the Bulletin analysed is to report the results of a trial test showing the advantages and disadvantages of different methods of transplanting coffee plants.

Coffee seedlings with only 5 to 6 pairs of leaves, when transplanted with the roots incased in a ball of earth from the nursery, show little difference in early growth and yield as a result of transplanting from those transplanted with roots bare of earth, provided the latter transplanting is properly done.

By leaving the seedling in the nursery 1 year longer, that is to say by transplanting them at the time of the second rainy season after sowing, a more even stand may be obtained, since the plants are thrifter and better able to cope with unfavourable conditions. The fact that it is more eco-

STIMULANT,  
AROMATIC,  
NARCOTIC,  
AND  
MEDICINAL  
CROPS

nomical to leave the plants in the nursery than to transplant them, makes it also advisable to adopt this method.

When the seedlings are removed from the nursery to the plantation at approximately 18 to 20 months after the seed has been planted, a considerably earlier growth and increased yield may be expected to result from transplanting the roots incased in a block of soil, rather than with the roots free of soil. This difference should be considerably greater in average planting than in the experiments when care was taken to avoid breaking and drying out the roots. In the 1st. experiment, the plants removed with a ball of earth measured at the end of the 1st. year 35 per cent. more in height than those transplanted with bare roots; at the end of the 2nd. year they were 23 per cent. higher than the check. Their yield the second year was double that of the check. In a 2nd. test, the increased growth for the 1st. year was nearly 12 per cent. greater, while their yield the 2nd. year was 3 times as great. In the 3rd. experiment, the increase in height was 43 per cent. greater than that of the check at the end of 2 years, while the crop was more than doubled. The writer therefore recommends the followings method of handling young coffee seedlings: mature seed selected from trees of desirable types may be planted immediately after pulping, or may be washed free of the mucilaginous coating, and kept in an airy shaded place for a period not longer than 3 or 4 months previous to planting. Excessive drying must be avoided, as this will destroy the viability of the seed.

The seed should not be planted deeply,  $\frac{1}{4}$  in. of soil being a sufficient covering. The seeds may be sown in the nursery, or in boxes from which they may be transplanted to the nursery when the cotyledons have hardened. Previous to germination, the soil should not be allowed to dry out. In the nursery, the seedlings should not be less than 8 inches apart. Here they may remain until the 2nd. rainy season after planting.

Too dense shading or an exposure to too full sunlight should be avoided.

Numerous small scattered nurseries are preferable to fewer and larger ones, as they greatly facilitate the transportation of the trees at the time of planting.

Where the soil is a heavy clay, it is necessary to transplant the seedlings with their roots incased in a ball of the soil. The plant should be so set that in its permanent location it is no deeper than it was in the nursery, with the root collar just below the surface of the soil. A very common practice, and one which is to be condemned, is that of setting a tree in a depression in which the soil gradually accumulates, burying deeply those roots which should remain near the surface and facilitating the entrance of root fungi.

**823 - The Effect of Some Alkaline Salts Upon the Fire-holding Capacity of Tobacco. —**

KRAYBILL, HENRY, R. (Contributions from the Hull Botanical Laboratory), in *The Botanical Gazette*, Vol. LXIV, No. 1, pp. 42-56. Chicago, Illinois, July 1917.

The term, burning qualities of tobacco, expresses many characters, of which the chief are: uniformity of combustion — colour of the ash — compactness and cohesion of the ash — and fire-holding capacity; the latter signifies the length of time the leaf continues to burn after having been



set fire to. This latter character has been the principal criterion used in determining the burning qualities of tobacco.

The writer rapidly considers the opinions hitherto expressed by various other writers on the subject of the factors influencing the fire-holding capacity. As these opinions are contradictory, the writer, in order to elucidate the question, studied the effects of different salts of potassium, or similar bases, upon the burning qualities of tobacco. He used carbonates, oxalates and citrates of potassium, sodium and lithium, carbonate of rubidium, tartrates of sodium and of potassium, etc. With a view to comparison, he also studied the effect of several alkaline salts upon the combustion of various kinds of paper and of a piece of sugar. In all these cases, the salt solutions used were normal 28.9 per cent. solutions. It has been suggested, that the effect of the different salts upon the colloidal condition of the substance of the tobacco leaf may be related to the fire-holding capacity of the latter. In order to test this point, some leaves were acidified by treatment with 0.5 normal acetic acid, others alkalinised by treatment with a normal 0.2 solution of sodium hydrate. The salt solutions were applied in the form of very fine spray by an atomiser. The leaves, after being sprayed, were placed under a bell-glass, in order to allow the salts to extend over the whole surface; the duration of the combustion being determined for each leaf from 3 pieces, cut respectively from the tip, centre, and base of the leaf. Each determination was repeated on several leaves.

The results obtained indicate that :

1) Carbonates of caesium, rubidium and potassium have a marked effect in aiding the fire-holding capacity of tobacco, while on the other hand, carbonates of sodium and lithium have not the same effect. The 3 first salts are given in decreasing order of efficiency.

2) Of the oxalates used in the experiments, only potassium oxalate produced any effect. As regards carbonates and oxalates in an alkaline medium, lithium carbonate and oxalate as more efficacious than the same sodium salts in bringing about the precipitation of the colloids, and are also a little more efficacious in promoting fire-holding capacity. In the case of the citrates, this relation does not exist. The carbonates of potassium, rubidium and caesium behave in the same manner. It is thus doubtful whether the effect of salts upon the colloid condition of the tobacco leaf is of any importance as regards the burning qualities of the latter.

3) Only citrate of potassium promotes the burning qualities. The action of the citrates of sodium and lithium is almost *nil*.

4) Of the compounds of potassium, the organic salts of this metal, the carbonate, tripotassic phosphate, bipotassic phosphate and the sulphate increase the fire-holding capacity, while the chloride, the acid sulphate and the monopotassic phosphate have a bad effect upon the burning qualities.

5) Carbonate of sodium slightly increases the fire-holding capacity, but all the other sodium salts have no effect, or a harmful one.

6) The data obtained do not support the idea that the favourable action of salts of potassium is to be attributed to their reduction.



7) It has been ascertained, that the injurious effects of chlorides is not due to the fact that they melt, as was suggested by BARTH (*Landwirtschaftliche Versuchsstationen*, Vol. 39, pp. 81-104, 1891).

8) It has been proved, that the favourable action of carbonate of potassium is not caused by the alternate liberation and absorption of carbonic acid.

9) The effect of salts in raising the leaf temperature may be of some importance.

10) The problem is most likely a complicated one, and the action of the salts of caesium, potassium and rubidium may be attributable to many factors.

11) It would seem probable, that caesium, potassium and rubidium in the form of certain salts, such as carbonates, sulphates and phosphates, have a specific catalytic action in combustion, and that the chlorides have a negative catalytic action. The writer intends to study the progress of the decomposition of several organic substances treated with alkaline salts and subjected to temperatures equal to those reached by a cigar while burning.

Appended to the article is a bibliographical list of 17 publications mentioned in the text.

#### HORTICULTURE

824 - **Variety Tests of Vegetables Carried Out at the Maryland Agricultural Experiment Station, United States.** — WHITE, T. H., in *Maryland Agricultural Experiment Station Bulletin* No. 204, pp. 231-262. College Park. M. D., March 1917.

The testing of new varieties as soon as they are put on the market is an important part of the work of the Experiment Station. The Bulletin analysed gives the results obtained in the past 10 years. The following are the varieties which seemed the best, or the most interesting.

ASPARAGUS. — There is little difference in asparagus varieties. Palmetto is a good variety and resistant to rust (*Puccinia Asparagi* D. C.).

BEETS. — All the varieties tried: Early Blood Turnip — Extra Early Egyptian — Early Model — Early Eclipse — Early Bassano — Black Red Ball — Long Blood Red — Detroit Dark Red — are excellent.

LIMA BEANS (*Phaseolus lunatus*). — One of the best climbing varieties is the King of the Garden. Carolina, or Sieva, is a small, very prolific sort; the same may be said of Henderson's Bush and Dreer's Bush. Though Fordhook Improved Bush is a dwarf variety, its pods and beans are as good as those of the large pole beans. It does best on light, well-drained soils.

SNAP BEANS. — The best varieties are: Extra Early Valentine Bush, very early — Valentine Wax, a little later — Longfellow: gave the largest yield, (25 ft. of row produced 1134 pods weighing 14 lbs. 2 oz.). — Dutch Case Knife — Kentucky — Wonder and Lazy Wife Pole.

GARDEN PEAS. — In general these are divided into the classes of round or wrinkled, dwarf and tall. The round smooth peas are mainly hardy and early. The wrinkled varieties are later and less hardy. In 1914 the following varieties produced the best crops: Carter's Daisy (7 lbs. 4 oz. from 25 ft. of row) — Sensation (7 lbs. 2 oz.) and Juno (7 lbs. 2 oz.). In

1915, the best crops were obtained from : Marvellous (7 lbs. 8 oz.) — Extra Early Blue Bantam (7 lbs. ) — Telephone (5 lbs. 8 oz.) — in every case the row was 25 ft.

The early peas which are most widely planted are Alaska and its strains. American Wonder and Nott's Excelsior are the dwarfest and earliest of the wrinkled varieties. Stratagem and Thos. Laxton are good varieties of a somewhat taller class of wrinkled peas. Telephone is the wrinkled pea most extensively grown by the market gardeners. Champion of England is very late. To keep up as long a succession as possible for picking, the following varieties should be planted *early* : Alaska — Extra Early Blue Bantam and Early Springtime (smooth varieties) ; while some of the wrinkled kinds to be sown *late* are : Nott's Excelsior — Little Marvel — Thos. Laxton — Stratagem — Telephone — and Champion of England.

MUSK MELONS. — The best varieties are Rockyford — Eden Gem — Buskirk's Gem — Salmon Tint Pollock — Buskirk's Rustproof (the latter is very resistant to leaf spot, *Cercospora melonis* Cke., but it is not immune and must be sprayed, like other varieties, with Bordeaux mixture) — Sweet Air — Knight — Anne Arundel — Baltimore Nutmeg.

CABBAGES. — a) *Early* : The cabbages most used for early planting are the smaller kinds which make a hard head in a short time. The head may be pointed, round, or flat. The first mature the quickest, and are largely planted. The round and flat types mature a week or two later: It is necessary that early cabbages should mature uniformly, that is to say, they should all be ready for market within two weeks after commencing to cut. The three best varieties of early cabbages are, in descending order Early Jersey Wakefield (pointed head) — Copenhagen Market (flat head) — Succession.

b) *Late* : These are generally large varieties, and range in size from 4 to 15 lbs. each. The experiments at the Maryland Experiment Station were mainly undertaken with a view to discover disease resistant and uniform heading kinds (see *Bulletin* No. 133 of the *Maryland Agricultural Experiment Station*). Late cabbages are subject to many diseases. The 3 worst of these are : "yellows" (*Fusarium Conglutinatum*) ; "black rot" (*Pseudomonas campestris*) ; and "black-leg" (*Phoma oleracea*). Of all the varieties tried, Volga is the best heading and most resistant variety. It is especially suitable for boiling, but not so good for slaw or saurkraut. Johnson's Ever-Ready and Late Stonehead are the Volga renamed.

Houser is very resistant, but does not head quite so uniformly as Volga. Autumn Giant is quite resistant and grows large, making good heads.

CHINESE OR PE TSAI CABBAGE. — No. 36054 U. S. Department of Agriculture was the best.

CAULIFLOWER. — The variety Snowball seems most suited to the conditions at the Station.

CELERY. — Golden Self-Blanching is the most extensively grown variety, for, though less vigorous and more subject to disease, it is easily blanched and has a good appearance. French grown seed is considered the best. A recently introduced variety called Henderson's Easy Blanching is very



vigorous and disease resistant. White Plume has variegated leaves; it is a very good variety. Giant Pascal when well blanched is the tenderest of the varieties grown; it is, however, very subject to rust (*Puccinia bullata* [Pers.] Wint.).

EGG PLANT. — Black Beauty — New York Improved — and Florida High Bush are good varieties.

LETTUCE. — The best varieties of the large, plain or wavy leaved heading types are: Big Boston — Cream Butter and May King. — White Seeded. Tennis Ball and Commodore Nutt are good of the dwarfier hard heading varieties of the same type. Giant Crystal Head and New York have fringed tender leaves that make heads — Curled Simpson and Grand Rapids have fringed leaves that do not make solid heads. The curly leaved types of lettuce are rarely attacked by tip-burn.

SUGAR CORN. — The earliest varieties are: Golden Bantam — Gillespie's Early Neck — Adam's Extra Early — resistant to drought: Seymour's Sweet Orange — White Evergreen — Cosmopolitan — Gillespie's Early Neck — Earliest Sheffield — Bloomsdale — New Ideal — Hickman's Extra Early — Holme's Premo — vigorous and little attacked by Smut (*Ustilago Maydis*): Minnesota — Metropolitan — Bountiful — Howling Mob.

RHUBARB. — Of the American stock, Gude's is the best variety, while Daw's Champion is the most distinct English variety tested.

TOMATOES. — Of early varieties "Earliana" occupies the first place, the second early kinds being Bonny Best — Chalk's Jewel — and John Baer; the latter is a cross between the two preceding varieties. Of the late varieties tested at the Station during the three years 1914-1916 those that produced the largest crops were: Rough Reich (7.9 tons per acre) — Shall-cross (6.5 tons per acre) — Kelly Red (6.5 tons per acre) — Greater Baltimore (6.4 tons per acre). Varieties resistant to wilt (*Bacillus Solanacearum* E. F. Smith) have been isolated from Greater Baltimore and Stone.

SWEET POTATOES. — These are divided into 2 classes, sweet potatoes and yams. The former are smooth and regular in appearance with brownish yellow skins, the latter are usually rough with white or red skins; the flesh of the yam is more mealy when properly cooked. The best varieties are: a) *sweet potatoes* — Big Stem Jersey — Yellow Nansemond — Early Golden — Yellow Jersey — Red Jersey — Vineland Bush — b) *yams*: Southern Queen — Pumpkin Yam — Pierson — Nancy Hall — Black Spanish — Bunch Yam.

IRISH POTATOES. — As an early potato, Irish Cobbler is excellent, but produces a small crop if grown as a late variety. Of the late sorts, White Mc-Cormock gave the highest yield during the three years 1913-1915, viz. 181.7 bushels per acre of primes and 28.7 bushels per acre of culls. In these tests the varieties are classified as follows in descending order of yield: Empire State — Manistee — Rehoboth — Pat's Choice — Green Mountain — Pat Murphy's Choice — Enormous — Endurance — World Wonder — Norking — Million Dollar — American Giant — Carman No. 3 — Norcross — Peerless Junior — Rural New Yorker — Irish Cobbler.



825 - Plum-Growing at the Maryland Agricultural Experiment Station. — HOLMES, F. S., in *The Maryland Agricultural Experiment Station, Bulletin No. 207*, pp. 295-326. College Park M. D., May 1917.

FRUIT  
GROWING

The cultivation of plums in Maryland is neither extensive in scope nor intensive in character; this fruit is grown only for home use and the supply of the local market. The following table gives the number of fruit trees of bearing age in Maryland in 1910 and their production in 1909:

Apples	No. of trees in 1910	Production in 1909
Apples . . . . .	1 288 482	1 822 824 bushels
Peaches and nectarines . . . . .	1 497 724	324 609
Pears . . . . .	540 583	367 359
Plums and prunes . . . . .	69 996	13 526
Cherries . . . . .	82 305	42 315
Quinces . . . . .	20 936	6 359

At this time, the plum-growing industry is upon the decline in Maryland, on account of the low prices obtained for the product — the cultivation of insuitable varieties in many instances — the ravages of fungous diseases and insect pests. There are, however, only two really serious plum pests, brown, or ripe, rot (*Sclerotinia fructigena* [Pers.] Schroet.) and curculio (*Conotrachelus nenuphar*). All other diseases and insects are readily controlled and yet black knot (*Plowrightia morbosa* [Schw.] Sacc.) and San Jose scale (*Aspidiotus perniciosus*) have been allowed to destroy large numbers of plum trees. Losses ascribed to either should be charged to neglect instead.

The most widely grown varieties of plum are: Abundance, Shropshire, Burbank, Wild Goose, Red June, Lombard, German Prune, Satsuma, Shipper and Green Gage. A great many other varieties are, however, also cultivated.

The Maryland Agricultural Experiment Station at College Park has tested a number of native, Japanese, and hybrid varieties in order to determine their suitability for growing in the State. Blooming data for the varieties grown at the Station show that the flowering period of the Japanese varieties normally extends over the first half of April; that of natives over the latter half; and that of hybrids over the entire month.

Cross-pollination of plums is necessary in order to be sure of obtaining a crop. The orchard should be planted with several varieties blooming at the same time. The choice is facilitated by the tables in the Bulletin analysed which give the blooming dates of 70 varieties grown in the Station orchard. In the following summary the varieties are grouped according to species and sub-species and those of each group are arranged in the order in which they come into full bloom. The dates represent the time of full bloom for the earliest and the latest and also for the average of all the varieties of the same species.

*Prunus domestica*: Shipper, April 17.

*Prunus insititia*: Shropshire, April 21.

*P. triflora*: Berkman's (March 31) — Abundance — Hale — Bur

bank — Occident — Satsuma — Weeping Blood — Engree — Kelsey — Kerr — Georgeson — Chabot — Red June — Ogon — Maru — Delaware (April 14). Average for species, first bloom, April, 1.; full bloom, April 6; last bloom, April 11.

*P. americana*: Brittlewood, April 22.

*P. hortulana*: Dunlap (April 17) — Wayland — Golden Beauty — Reed — Cumberland (April 23). Average: first bloom, April 17; full bloom, April 22; last bloom, April 26.

*P. hortulana Mineri*: Maquoketa (April 19) — Forest Rose — Nebraska — Prairie Flower (April 22). Average: first bloom, April 15; full bloom, April 21; last bloom, April 26.

*P. nigra*: Cheney (April 19) — Smith Red (April 20). Average: first bloom, April 14; full bloom, April 20; last bloom, April 26.

*P. angustifolia variens*: Munsen (April 15) — MacCartney — Yellow Transparent — Lone Star (April 20). Average: first bloom, April 13; full bloom, April 18; last bloom, April 23.

*P. Munsoniana*: Newman (April 15) — Whitaker — Wild Goose — Smiley — Cleveland (April 20). Average: first bloom, April 14; full bloom, April 18; last bloom, April 24.

*Hybrids*: Climax (March 31) — Chalco — Apple — Nona — Kelmyro — Dorio — Kelbalan — Wickson — Bartlett — Ragland — Red October — Combination — Kelroba — First — Shiro — Waugh — Yates — Gonzales — America — Six Weeks — Golden — Excelsior — Holland — Marianna — Preserver — Duke — Milton — Goose Dye — Idall — Goose O (April 20).

The essentials of success in plum growing are the selection of suitable varieties; the choice of a proper orchard site, good orchard management, and right methods of picking, packing and marketing. For Maryland, the writer especially recommends the following varieties: Abundance — America — Berger Burbank — Chabot — Downing — German Prune — Gonzales — Greengage — Milton — Newman — Red June — Shropshire — Whitaker — Wild Goose.

#### FORESTRY

826 — **The Pine Trees of the Rocky Mountain Region.** — SUDWORTH, G. B. (Dendrologist), in *United States Department of Agriculture Bulletin* No. 460 (Contribution from the Forest Service, Professional Paper), pp. 1-46, XXVIII plates, 14 maps. Washington, D. C., May 26, 1917.

A monograph on the dendrology of the different species of pine tree (*Pinus* sp.) that inhabit the Rocky Mountain region. The exact limits of the territory covered by this publication are given in a preceding article of the writers (1). Some 70 species of pines are known in the world; 36 of them grow in the United States, 14 of the latter being found in the Rocky Mountain region. Six of these Rocky Mountain species occur also in the Pacific slope region, and 1 ranges eastward from the Rockies in Canada into the Atlantic Coast country (*Pinus Banksiana*). The cones of some pines

(1) See B., 1915, No. 1165 and R., January 1917, No. 50.

(Ed.)



may remain closed for several, or many seasons; those of one American species (*Pinus albicaulis*) never open naturally. This explains how certain pines often reproduce themselves after a forest fire.

The pines described are divided into 2 large groups:

**WHITE PINES:** *Pinus monticola* Douglas, known as Western white pine, this must not be confused with the true white pine, *Pinus Strobus*, the wood of which tree it now largely replaces (1). — Limber pine (*Pinus flexilis* James) — white bark pine (*Pinus albicaulis* Engelmann) — Mexican white pine (*Pinus strobiformis* Engelmann) — Mexican piñon (*Pinus cembroides* Zuccarini), this tree has the heaviest wood of all the Rocky Mountain pines; it is used only for fuel and other domestic purposes; the seeds are edible — Piñon, or nut pine (*Pinus edulis* Engelmann), the seeds of this pine are eaten by the Indians and settlers — Single-leaf pine (*Pinus monophylla* Torrey and Frémont) the only single-leaved pine of North America; the seeds are also much used for food — Bristle-cone pine (*P. aristata* Engelmann).

**YELLOW PINES.** Arizona pine (*Pinus arizonica* Engelmann) — Western yellow pine (*P. ponderosa* Lawson) is one of the most majestic of the pines of N. America: in general, the height is from 125-140 ft. with a practically clear trunk of from 40-60 ft., while some trees are said to have attained the height of over 200 ft. It produces one of the most valuable woods of the Rocky Mountain region; the wood is, however, only moderately durable in contact with earth, or when exposed to the weather in an unprotected state — Apache, or Arizona longleaf pine (*Pinus apachea* Lemmon) — Chihuahua pine (*P. chihuahuana* Engelmann) — Lodgepole pine (*P. contorta* Loudon) — Jack pine (*P. banksiana* Lambert) (2).

827 — **The Eucalyptus as Fuel in North Africa.** — TRABUT, in *Comptes rendus des Séances de l'Académie d'Agriculture de France*, Vol. 3, No. 28, pp. 834-836. Paris, July 25, 1917.

Certain countries, owing to the difficulty of obtaining coal, have been led to employ wood for fuel on a large scale. The cultivation of trees of rapid growth is a question of great interest. The eucalyptus, especially *E. Globulus*, are among the almost interesting trees in this connection. Two pounds of dried wood of *E. Globulus* are equal to one pound of briquettes for heating locomotives. It is already held in considerable value on the Algerian and Tunisian railways, which are considering the possibility of its continued employment.

*E. Globulus* appears to be the best paying species owing to its rapid growth and to the closeness with which it can be planted.

A hectare (2.47 acres) of bare and unutilised marshy ground, such as the Fetzara basin (13 000 hectares) would allow of the planting, at a trifling cost, of 1600 to 2 000 one year-old eucalyptus seedlings. When 6 years old these trees would have a diameter of 20 cms. and a height of 12 to 15 metres. A first cut could then be made which would give 500 to 600 cubic metres.

(1) See B. 1915 No. 719. — (2) See B. 1911, No. 1204 and B. 1915, No. 1168.

(Ed.).



After this felling the trees begin to grow again from the stump and every 6 years give an increased quantity of wood of improved quality. In the conditions described above, a hectare of *E. globulus* is capable of yielding 50 metric tons of dry timber for fuel.

The eucalyptus, which is very hard when dry, is easily cut when green. The branches can be utilised for making briquettes or the leaves distilled for oil, the yield being 1.5 per cent. of the fresh leaves.

## LIVE STOCK AND BREEDING.

### HYGIENE OF LIVESTOCK

828 - **Poisoning of Cattle by Ragwort (*Senecio Jacobaea* L.), in England.** — *The Journal of the Board of Agriculture*, Vol. XXIV, No. 4, pp. 433-436. London, July 1917.

This note has been prepared by the Chief Veterinary Officer of the Board of Agriculture.

In South Africa, Canada and New Zealand much attention has been given to the subject of cattle poisoning by certain species of ragwort. Until the actual cause was discovered, the cases were attributed to a disease which was known under different names (Picton, Winton and Molteno disease). It is not generally recognised that the common British ragwort (*Senecio Jacobaea* L.) is poisonous to cattle. This probably arises from the fact that poisoning under natural conditions is a slow process, the action of the poison being cumulative. The actively poisonous agent in the plant seems to be one or more alkaloids which it contains.

In a case recently studied in the Laboratory of the Board of Agriculture, the first symptoms of the poisoning appeared in a herd of cattle 44 days after they had begun to eat dry forage containing much ragwort. The time elapsing between the first appearance of definite symptoms and death varied from a few days up to a month. Some of the animals did not show definite symptoms until 12 days or more after the feeding with ragwort had been discontinued.

The animals suffering from poisoning show signs of nervous disturbance; in some there may be diarrhoea, but usually there is marked constipation. The principal lesions found are inflammation of the mucous membrane of the bowel; small haemorrhages are present under the above-mentioned membrane and in the pericardium; in acute cases, the liver becomes altered.

There is no cure for the disease, and prevention resolves itself into removing the ragwort from the forage, or eradicating it from the pastures. The latter may be done: 1) by pulling up the plant where circumstances permit; 2) by cutting the plants in the flowering season, that is to say, late in July or early in August, if the operation can only be done once; the cut portions of the weed must be gathered up at once and burnt; 3) the ragwort may be cut early in July and again 6 weeks later; in which case there is no need to gather up the cut portions; 4) by grazing infested land with sheep in the winter and early spring.

There is reason to believe that ragwort is most poisonous during the flowering season, from June to early August. The question of whether

flowering ragwort is poisonous to sheep is now being investigated at the Board's Laboratory. Having regard to the experience acquired in practice of grazing sheep on ragwort pastures during the winter and early months of the year, it would seem reasonable to assume that the practice is not attended by bad results. This is, however, still an open question.

829 - *Paspalum notatum*, the Cause of the Disease of Cattle known as "Tembleque" or "Chucho" in the Argentine. — ROSENBUCH, FRANCISCO and ZABALA, JOAQUÍN, in *Anales de la Sociedad Rural Argentina*, Year LII, Vol. LI, pp. 245-248, coloured plate. Buenos Aires, May 1917.

In May 1916, the writers, who are members of the Bacteriological Institute of the "Departamento nacional de Higiene", had occasion to remark, in the province of Buenos Aires, an hitherto unknown disease of cattle characterised by the animal shivering and falling on the ground (whence the name of "tembleque"), these symptoms being sometimes quickly followed by death. No parasitic micro-organism was found in the blood of affected animals and injections of such blood in cattle and other kinds of animals gave negative results. The authors were thus obliged to state that "tembleque" was produced by poisoning due to some unknown cause.

The truth of this diagnosis has now been shown by examination of the flora of the pastures where the disease has appeared. *Paspalum notatum* Flug. ("gramillón" or "pasto dulce") is very abundant; it is absolutely harmless when healthy but is poisonous to cattle when attacked by a fungus of undetermined species which forms sclerotia upon the spikes, these sclerotia being of a pinkish colour tending more or less to white, grey or black.

The inflorescences attacked by the fungus are innocuous to horses. So that, as a preventive measure, the writers recommend turning horses into the fields before cattle are allowed to graze them. If this is not practicable the field should be harrowed as this shakes out the infected seeds, these latter being much more easily detachable than the sound ones. With regard to curative measures, the writers recommend tapping the jugular; subcutaneous injections of eserine and of chloride of pilocarpine; purgatives.

DR. JUAN N. MURTHAGH has also observed this disease in the provinces of Buenos Aires and of Santa-Fé. The number of cattle infected was from 30 to 50 %.

830 - Experiments in Controlling Ectoparasites on Poultry in the United States (1). — BISHOPP, F. C. and WOOD, H. P., in *Farmer's Bulletin* 801, United States Department of Agriculture, 26 pp. 14 fig. Washington, May 1917.

A description of the following external parasites on poultry and the methods of control adopted against them.

I MITES. "Common Chicken Mite" (*Dermanyssus gallinae* De Geer) — "Scaly Leg Mite" (*Cnemidocoptes mutans* Robin). — "Depluming Mite" (*Cnemidocoptes gallinae* Railliet) — *Laminosioptes cysticola* Vizioli — *Cytoleichus nudus* Vizioli — *Rivoltasia bifurcata* Rivolta — *Freyana chanayi*

(1) See also B. 1915, No. 1313.



Trouessart (recently found by the writers as an external parasite of the turkey in Texas and Louisiana) — *Megninia cubitalis* Megnin.

II LICE. — More than 40 species of lice are found on the various domestic fowls.

LICE ON CHICKENS: "Head Louse of Chickens" (*Lipeurus heterographus* Nitzsch) — "Body Louse of Chickens" (*Menopon biseriatum* Piaget) — "Shaft Louse" (*Menopon pallidum* Nitzsch) — "Wing Louse" (*Lipeurus variabilis* Nitzsch) — "Fluff Louse" (*Goniocotes hologaster* Nitzsch) — "Large Hen Louse" (*Goniocotes abdominalis* (Piaget) — "Brown Chicken Louse" (*Goniodes dissimilis* Nitzsch), which has not before been reported to occur in America, but which the writers have found in Texas and Florida.

LICE ON TURKEYS: *Menopon biseriatum* — *M. pallidum* — "Large Turkey Louse" (*Goniodes stylifer* Nitzsch) "Slender Turkey Louse".

LICE ON DUCKS: *Docophorus icterodes* Nitzsch (one of its varieties attacks geese) — *Lipeurus temporalis* Nitzsch.

LICE ON PIGEONS: "Slender Pigeon Louse" (*Lipeurus baculus* Nitzsch) — "Broad Pigeon Louse" (*Goniocotes compar* Nitzsch).

The writers advise starting the campaign against these parasites during the late summer or early autumn, for, at this time of year, weather conditions are usually favourable for dipping, and much of the superfluous stock has been disposed of, so there are fewer birds to treat. If the autumn treatment has been neglected, it is imperative that the flock be cleaned of lice before the brooding time in the spring. The writers have tested a number of the new materials most generally advocated for lice destruction, and several new compounds which it was thought might be effective.

The writers state that the common chicken mite can be destroyed by 2 or 3 treatments of the whole fowl-house (roosts, nests, walls and roof) at intervals of one month. The fowl-house should be thoroughly and carefully sprayed with crude petroleum, or with one of the liquids used for the preservation of posts and other timbers set in the ground and consisting of anthracene oil with zinc chloride added. Crude carbolic acid is quite effective, but does not last long. The best cure for scaly leg is to dip the fowl's legs into crude petroleum; if necessary, the treatment may be repeated in a month's time.

For lice destruction, no remedy has been found so satisfactory as sodium fluoride (commercial 90-98 % NaF). Its action is comparatively slow, but, as the material persists, the adult and young lice are all destroyed. One application is sufficient. Sodium fluoride may be applied in two forms, as a dust and as a dip. In the first case, the best method consists in placing pinches of the powder among the feathers next to the skin, and as all species of lice do not migrate freely from one part of the bird to another, it is necessary to place small amounts of the insecticide on different parts of the infected fowl: one pinch on the head, one on the neck, two on the back, one on the breast, one below the vent, one on the tail, one on either thigh, and one scattered on the underside of each wing when spread. The sodium fluoride can also be applied by means of an ordinary can with holes punched in the bottom and provided with a close-fitting lid on the other end. Larger quan-



tities of the insecticide are, however, used in this way; further the dust floats in the air, thus causing irritation of the throat and nose of the operator. The amount of sodium fluoride used may, however, be reduced by adding four parts of road dust or flour to each part of the chemical, while the operator can be protected by wearing dust guards over the nose, or by simply keeping pieces of wet cloth over the nose and mouth.

The writers are of opinion that the application of the insecticide by means of a dusting machine, or revolving barrel, might bruise the fowls and would be irritating to the air passages of the birds.

The dipping method is easier and quicker. Three-fourths to 1 ounce of commercial, or  $\frac{2}{3}$  ounce of chemically pure sodium fluoride is added to each gallon of water. The water should be tepid and the tub filled to within 6 or 8 inches of the top. In dipping the fowls, it is best to hold the wings over the back with the left hand and quickly submerge the fowl in the solution, leaving the head out while the feathers are thoroughly ruffled with the other hand, so as to allow the solution to penetrate to the skin of the bird. The head is then ducked once or twice. The total time required for each fowl is from 30 to 45 seconds. The approximate cost of treating 100 fowls by the pinch method is \$1.25 while the dipping method reduces the cost to \$0.75. These estimates include labour and cost of material.

Dusting with flowers of sulphur has been found efficacious, but about 4 days are required for the fowls to be quite freed from living lice.

The writers have also found that dipping fowls in a soap solution (1 oz. per gall. of water) will destroy all lice present, but a second dipping 10 days later is necessary in order to destroy the lice that have hatched out in the interval. As the soap solution causes a complete wetting of the feathers, it should only be used during favourable weather, as otherwise there is danger of producing colds.

Amongst other remedies used for the control of fowl lice, a mixture of crude carbolic acid, gasoline and plaster of Paris may be mentioned: it, however, must be applied several times. Mercurial ointment is effective in the case of *Menopon biseriatum*, but is of little use in the control of *Lipeurus heterographus* and *L. variabilis*, the treatment having to be repeated several times in the case of the latter, which makes it very expensive. Compounds with a pyrethrum base do not completely destroy the lice. For head lice in young chickens, carbolated petrolatum applied in small quantities has been found quite satisfactory. Medicated nest eggs said to control poultry lice are on the market. For the most part, these consist largely of naphthalene, and though they destroy the lice, are markedly injurious to the hen's eggs as well as to the bird; and if they are allowed to remain for a considerable length of time beneath a hen, she may die as a result.

## CATTLE

831 - Experiments to find a Basal Ration for the most Economical Feeding of Dairy Cattle under Northwestern Conditions in the United-States. — ELLINGTON, E. V., in *University of Idaho Agricultural Experiment Station, Annual Report Bulletin No. 92*, pp. 16-18. Moscow, Idaho, December 1916.

The experiments undertaken by the Department of Dairy Husbandry of the Idaho Experiment Station to establish a basal ration for dairy cattle under northwestern conditions have been completed.

It has been found that the following ration can be adapted to the high producing cow or to the low-producing cow and, moreover, may be adapted to animals of different weights: *Alfalfa hay, one part; corn silage, 4 parts, grain (consisting of barley, 4 parts; bran, 2 parts; linseed oil meal, 1 part), one part.*

To show how closely this ration conforms to the standards established by ARMSBY the following data are given:

900-lb. Cow, Giving 20 lbs. Milk, Testing 4 per cent.

	Digestible protein	Energy value (calories)
For maintenance . . . . .	0.46	5.70
To produce 20 lbs. milk . . . . .	1.00	6.00
	1.46	11.70
Alfalfa hay 7 lbs., silage 28 lbs., and grain 7 lbs. gives. . . . . lbs.	1.45	11.98

900-lb. Cow, Giving 40 lbs. Milk, Testing 4 per cent.

	Digestible protein	Energy value (calories)
For maintenance and milk production. . . . .	2.46	17.70
Alfalfa Hay 10 lbs., silage 40 lbs., grain 10 lbs., gives. . . . . . lbs.	2.48	17.98

1500-lb Cow, Giving 20 lbs. Milk, Testing 4 per cent.

	Digestible protein	Energy value (calories)
For maintenance and milk production . . . . .	1.65	13.90
Alfalfa hay 8 lbs., silage 32 lbs., grain 8 lbs., gives . . . . . lbs.	1.89	13.69

1500 lb. Cow, Giving 40 lbs. Milk, Testing 4 per cent

	Digestible protein	Energy value (calories)
For maintenance and milk production . . . . .	2.65	19.90
Alfalfa hay 11 lbs., silage 44 lbs., grain 11 lbs., gives . . . . . lbs.	2.60	18.84

These rations correspond very closely to the rough rule followed by many dairymen, in feeding one pound of grain daily for every pound of butter fat that the animal produces weekly. The complete set of data secured by these experiments will be published in a "Dairy Farm Management" Bulletin of the Idaho Experiment Station.

832 - **The Mechanical Milker in Dairy-Herd Management in Idaho.**— ELLINGTON, E. V., in *University of Idaho Agricultural Experiment Station, Annual Report Bulletin No. 92*, pp. 16-18. Moscow, Idaho, December 1916.

The Department of Dairy Husbandry of the Idaho Experiment Station has continued during the past year the dairy herd management investigations. A considerable portion of the time was spent with the milking machine installed by the Sharples Company for use on the College herd. Data were compiled to show the economy of milk production and the effect on the health of the herd. Attention is being given to the control of the bacterial content of the milk. It is observed that there was no decrease in production during the first eight months in the lactation period of the individual cows as compared with similar preceding lactation periods of the same cows. It was also observed that with the same amount of labour necessary for handling the University herd when milking by hand, the herd could be milked three times a day with a resulting average increase in milk flow of 22 %. This procedure is probably not practical for the farmer who is milking cows as a side line, but for the man who devotes his entire time to dairying and who is supplying milk for city markets or cheese factories, this is an important factor in the management of the dairy herd. The effect of the mechanical milker on hard-milking cows is worthy of note. Very frequently cows that are capable of high production are not given the attention they deserve because of difficulty experienced in drawing the milk. It has been noted in the case of one pure-bred Holstein cow in the University herd, Philidea Young De Kol, that with the mechanical milker in 1916, during eight months 11 795 pounds of milk containing 360 pounds of butter fat were produced. In 1915 during a similar period with hand milking, 8001.5 pounds of milk with a fat content of 274 pounds were produced and during 1914 for a similar period with hand milking, 8500 pounds of milk with a fat content of 336 pounds were produced. Machine milking with this class of cattle seems to increase the length of the lactation period as the average hand milker has a tendency to dry up the cow that he finds difficult to milk.

Close inspection was given each individual animal by the Department of Veterinary Medicine to determine the effect of mechanical milking on the udders. So far no ill effects have been noted.

Special precautions were taken to keep the machine in perfect repair at all times. The results obtained so far, however, do not warrant an unqualified endorsement of the mechanical milker.

The observations should extend over two consecutive lactation periods.

833 - **A Study of Leading Breeds of Sheep with Special Reference to Production Factors in Idaho.**— IDDINGS, E. J. and HICKMANN, C. W., in *University of Idaho Agricultural Experiment Station Annual Report, Bulletin No. 92*, pp. 4-8. Moscow, Idaho, December 1916.

During the past year the Idaho Experiment Station has conducted, as in former years, the work in sheep breeding and management. Comparisons were made of the Southdown, Shropshire, Hampshire, Cotswold and Rambouillet breeds with respect to the average weight of the ewe, weight



of fleece, economy of maintenance, weight of lambs at birth, lambing percentage and daily gain of lambs for the first three months after birth. At present there are available records as follows: On weight of fleece, five years; on weight of ewes, three years; on economy of maintenance, three years; on weight of lambs at birth, three years; on lambing percentage, five years; on daily gain of lambs, three years. It is interesting to note at this time the relative economy of maintenance of the Southdowns and Rambouillets, the prolificacy of Hampshire ewes and size of their lambs at birth, and the relatively rapid gains of the Hampshire lambs. In addition to the work of preceding years, there were obtained this year the milk yield of the ewes of different breeds and data on its composition for, as stated above, there appear to be pronounced differences between lambs of different breeds in rate of growth. A study of tabulated results on the milk yield of the ewes of different breeds and its composition thus far fails to give an adequate explanation for differences in the growth of lambs noted. This feature of the work will be continued during this year and an additional breed, the Lincoln, will be introduced into the work for the first time. As soon as possible, measurement work will be started to determine rates of growth of the lambs of the various breeds. In connection with the flock-maintenance features of the work, a test will be made during the coming year of peas and oat silage.

A summarised statement of results secured up to the present time from this line of investigation appears in the following table I.

TABLE I. — *Comparative Breed-Management Work.*  
Annual records on 35 to 40 ewes of five well-known sheep-breeds,

Breed	Wt. fleece at 5 years lbs.	Rank based on economy of maintenance		Birth weight of lamb (3 year average) lbs.	Lamb- ing % (3 year average)	Daily gain lambs for 3 month average (3 years av.) lbs.	Aver. daily milk yield in lbs. 2 ewes (1 year)	Butter fat % 2 ewes (1 year)	Total solids % 2 ewes (1 year)
		1914-15	1915-16						
Rambouillet . . . .	14.1	1	2	8.3	147	0.45	2.32	8.82	14.66
Hampshire. . . . .	7.8	3	4	9.4	173	0.61	2.38	6.64	11.98
Shropshire. . . . .	11.2	5	3	8.2	154	0.49	1.65	9.02	14.86
Southdown. . . . .	7.3	2	1	7.1	116	0.39	1.22	8.60	14.61
Cotswold . . . . .	15.1	4	5	7.0	142	0.45	2.46	8.62	14.98

834 - **Lamb Feeding Experiments (1) in Nebraska.**— GRAMLICH, H. J., in *The University of Nebraska, Bulletin of the Agricultural Experiment Station* No. 153, pp. 1-26. Lincoln, Neb., October 1916.

During recent years much interest has developed in the fattening of lambs on Nebraska farms. In the past the feeding has been done mostly

(1) As regards lamb feeding in U. S. A. see R., 1917, January, No. 65 and May, No. 468. (Ed.).

by speculators, who have owned or rented yards at convenient points and shipped in lambs by the train load direct from the western ranches. The one-car feeder who fattens the lambs upon his farm, thereby utilizing much cheaper roughage, has now substituted the speculator.

The purpose of these experiments was to secure experimental data regarding the comparative values of corn and alfalfa hay fed in various forms both with and without corn silage.

They compared a ration containing good alfalfa hay for roughage with one containing a poor grade of hay, likewise a ration of corn and good alfalfa with one of the same feeds plus corn silage. A ration of shelled corn and alfalfa hay was compared with one in which both the hay and corn were ground. A ration of ground corn and ground alfalfa was compared with one of the same feeds with corn silage added.

The principal results of the feeding experiments described and discussed in this Bulletin, which contains 12 tables of numerical data, are summarized as follows:

1) The addition of corn silage to a ration of shelled corn and alfalfa hay increased the daily gain 0.005 lb. per lamb and increased the cost of producing 100 lbs. gain 4 cents, but did not affect the net profit per lamb.

2) With shelled corn at 60 cents per bushel and alfalfa hay at \$ 10 per ton, lambs on a heavy feed of shelled corn (approximately 1.5 lbs.) and 1 lb. of alfalfa made gains at a cost of \$ 5.11 per 100 lbs.

3) Lambs on ground corn and ground alfalfa consumed 0.126 lb. more corn and 0.093 less alfalfa daily than lambs on shelled corn and whole alfalfa hay. Lambs on ground corn and ground alfalfa made daily gains of 0.371 lb. at a cost of \$ 6.12 per 100 lbs. while those on shelled corn and alfalfa hay made daily gains of 0.393 lb. at a cost of \$ 5.11 per 100 lbs. Grinding corn and alfalfa and feeding the two mixed together did not produce sufficient added gain to offset the labour cost of grinding.

4) Good alfalfa was worth double the value of the poor alfalfa. Lambs on good alfalfa and shelled corn gained 0.035 lb. more per head daily and at a cost of 17 cents per 100 lbs. less than lambs on poor alfalfa and shelled corn. Lambs fed good alfalfa consumed more roughage than those fed hay of poor quality.

5) The addition of 0.726 lb. corn silage daily to a ration of ground corn and ground alfalfa did not increase the daily gain, but did reduce the cost of 100 lbs. gain by 31 cents.

6) A ration of shelled corn, alfalfa, and silage produced 100 lbs. gain at a cost of \$ 5.15, whereas a ration of ground corn, ground alfalfa and silage produced 100 lbs. gain at a cost of \$ 5.81, thus indicating that the whole grain and hay in conjunction with silage was the more economical of the two rations.

7) Valuing corn at 60 cents per bushel, good alfalfa at \$ 8 per ton, and poor alfalfa at \$ 4 per ton in this experiment, 100 pounds gain on a ration of corn and good alfalfa cost \$ 4.88, and on corn and poor alfalfa \$ 4.90.



## PIGS

835 - **Economical Pig Feeding ; Experiments made in the United Kingdom.** — *The Journal of the Board of Agriculture*, Vol. XXIV, No. 4, pp. 436-439. London, July 1917.

Given the high price of foods which, under normal conditions, are also used for stock feeding, but which at the present juncture have to be reserved for human consumption, the problem arises of finding substitutes for the usual pig feeds.

One of the first solutions that presents itself is to turn the animals out to grass, either in fields (of clover, lucerne, or mixed pasturage) or in orchards and woods. During the winter months, grass would be replaced by hay. Green food does not suffice to fatten the animals, but it keeps them in good health. Putting pigs on pasture has the following advantages :

1) A great saving in food suitable for human consumption ; 2) sows kept on pasture are more prolific and much more vigorous than those kept in a sty ; 3) the young pigs reared in the open are larger and stronger than those born and bred in the sty ; 4) the pasture is improved by the presence of the pigs, provided that too many animals are not turned out ; if the field is one of lucerne, it is necessary to be able to cut 2 or 3 crops per year ; 5) when the pigs graze on wooded land, an appreciable profit is made from food which otherwise is often wasted.

The accompanying Table, which is chiefly based upon the practical experiments of HANSSON, is very useful as giving a choice of complementary food stuffs ; those that are marked with an asterisk have been used in the given quantities in the pig feeding experiments carried out by the Department of Agriculture and Technical Instruction for Ireland.

*Amounts in lbs. of Feeds Equivalent to 20 lbs. of Barley.*

	lbs.		lbs.
Wheat . . . . .	20	Butter milk . . . . .	120
Oats . . . . .	24	Whey . . . . .	240
*Maize . . . . .	19	Mangolds. . . . .	180
Peas . . . . .	20	Carrots. . . . .	160
Haricot beans . . . . .	20	Swedes. . . . .	200
Pea-nut cake. . . . .	16	Turnips . . . . .	250
Coco cake . . . . .	18	*Potatoes . . . . .	80
Palm-nut cake . . . . .	20	Clover hay . . . . .	44
Wheat bran . . . . .	24	Lucerne hay . . . . .	50
Gluten feed . . . . .	19	Green clover . . . . .	140
Dried brewer's yeast . . . . .	16	Green lucerne. . . . .	150
Dried brewer's grains. . . . .	26	Meadow grass. . . . .	126
Malt dust . . . . .	26	Silage (oats and vetch). . . . .	200
Separated milk . . . . .	120		

836 - **Pork Production Experiments on Field Peas in Idaho.** — IDDINGS, E. J. and HICKMANN C. W., in *University of Idaho Agricultural Experiment Station Annual Report, Bulletin No 92*, pp. 6-8. Moscow, Idaho, December 1916.

Experiments conducted during the summer of 1916 at the Idaho Experiment Station showed again that the "hogging off" of field peas is a practical and economical method of harvesting the crop and feeding the



hogs. The summarized results of the experiments are indicated in the following Table :

Lot	Area in acres	No. of pigs per lot	No. of days on test	Initial live weight lbs. (Aug. 16)	Final weight lbs.	Gain in lbs.	Average daily gain lbs.	Gain per acre lbs.	Value of pork	
									per acre hogs 8 c.	per acre hogs 9 c.
									\$	\$
1	0.82	14	28	1 246.5	1 700.0	453.5	1.16	553	44.24	49.77
2	0.84	26	21	2 123.5	2 913.5	790.0	1.45	940	54.44	63.84
3	0.70	16	21	2 010.0	2 452.0	442.0	1.32	631	50.48	56.79
4	1.52	18	35	2 875.0	3 560.0	685.0	1.09	450	36.00	40.50

The pigs in lot 2 were fed, in addition to the peas, rolled barley at the rate of two pounds per 100 pounds live weight, or a total of 1162 pounds. The barley cost \$ 30 per ton. The value of the amount fed was deducted in determining returns per acre from the peas.

It is pointed out that the hogs did the harvesting, thus reducing the labour of harvesting and feeding, and that the work left the land in excellent condition for succeeding crops.

837 - **Feeding Experiments to determine the Relative Efficiency of Vegetable and Animal Protein for Egg Production.** — FREN, MOORE, in *University of Idaho, Agricultural Experiment Station, Annual Report, Bulletin No. 92*, pp. 28-30. Moscow, Idaho, December 1916.

The relative value of vegetable and animal protein in the ration of laying hens is a subject that is the cause of much discussion among poultry men. Some experimental work has been done, but the question is still an open one. As a means of securing further information the following experiment was planned and started on November 1, 1915, by the Department of Poultry Husbandry of the Idaho Experiment Station.

Four pens of twenty-five fowls each were fed with the following rations :

Pen I		Pen II	
Grain	Mash	Grain	Mash
10 parts peas	3 parts bran	6 parts corn	2 parts bran
14 parts wheat	3 parts shorts	10 parts wheat	1 part shorts
6 parts corn	1 part corn meal		1 part corn meal
	1 part wheat meal		1 part wheat meal
	1 part pea meal		3 parts beef scrap
	6 parts oil meal		1 per cent charcoal
	1 per cent charcoal		
Nutritive ratio 1 : 4.2		Nutritive ratio 1 : 4.2	

Pen III		Pen IV	
1 part peas	1 part bran	6 parts corn	2 parts bran
5 parts corn	1 part shorts	10 parts wheat	2 1/2 parts shorts
10 parts wheat	1 part corn meal		1 part corn meal
	1 part wheat meal		1 part wheat meal
	1 part pea meal		1 1/2 parts beef scrap
	3 parts oil meal		1 per cent charcoal
	1 per cent charcoal		
Nutritive ratio 1 : 5.5		Nutritive ratio 1 : 5.5	

The grain was fed in deep litter at the rate of eight quarts a day per one hundred hens, and the mash in open hoppers. The rations were supplemented with green food, grit, shell and bone. In the calculation of nutritive ratios, Idaho analytical data on wheat, bran, and shorts have been used. All other analytical data and digestion coefficients have been taken from Henry's Feeds and Feeding. The fowls were all trap-nested and the number and weight of each were recorded. Moreover, the fowls were weighed at the beginning of the experiment, on May 1, and again on October 31, 1916, and individual weights recorded. The results of the first year are summarised in the following table giving the weights of eggs.

Pen	Per cent under 2 oz.	Per cent 2 oz.	Per cent over 2 oz.
I . . . . .	46.5	52.7	0.8
II . . . . .	15.2	72.7	12.0
III . . . . .	41.9	56.3	1.8
IV . . . . .	17.5	79.7	2.9

Pen No. II produced 55.8 per cent. more eggs than pen No. I, 51.1 per cent. more eggs than pen No. III, and 35.2 per cent. more eggs than pen No. IV.

The condition of health and gain in flesh show about the same percentage as that of egg production and weight of eggs. The difference in production between pens I and III and pens II and IV indicates that animal protein is essential for heavy egg production. In the ration of pen No. II the beef scrap constitutes 37.5 per cent. of the mash; in that of pen No. IV it constitutes 18.75 per cent. of the mash. The fact that pen No. II produced 35.2 per cent. more eggs than pen No. IV suggested the advisability of increasing the pen by one whose mash would contain an intermediate percentage (28 %) of beef scrap. This experiment with white Leghorn pullets is planned to extend over a period of at least three years.

838 - **Goose Raising in the United States.** — I, AMON, H. M. and LEE, A. R., in *U. S. Department of Agriculture, Farmer's Bulletin* 767, pp. 1-6. Washington D. C., February 1917.

Geese are raised successfully in all parts of the United States but are most abundant in the South and in the Middle West. According to the

census of 1910, Kentucky, Tennessee, Missouri and Arkansas contained about 400 000 geese each. The total number of geese declined, however, about 22 per cent. from 1900 to 1910, due largely to the lack of cheap pasture land for grazing, and perhaps partly to the limited demand for goose feathers and goose flesh.

Six breeds of geese have been admitted to the American Standard of Perfection, namely, Toulouse Embden, Chinese, African, Wild or Canada, and Egyptian. In addition to the standard breeds there is the so-called Mongrel goose, which is a hybrid made by crossing one of these varieties, or the common goose, with wild geese. The common goose found on many farms contains more or less blood of some of the standard breeds and of the wild goose, and is usually considerably smaller than the Toulouse or the Embden. The Toulouse, Embden, Chinese, and African are easily the most popular breeds of geese in the United States, the first two greatly leading the other breeds. An inquiry made in all parts of the country, where geese are commonly raised, by sending a question schedule to the breeders, gave the following results:

*Reports from the South.* Small common geese were kept very largely in the Southern States, while only a few breeders kept pure-bred geese, of which the Toulouse, Embden, Chinese, African, and Canada were the most popular in this order. Almost all these breeders picked feathers from the live geese once or several times during the year, some farmers picking the feathers as often as once in six weeks. Many reported keeping the geese largely for the production of feathers and did not consider them profitable as market poultry. The averages for these Southern States showed that the gander weighed 11.2 pounds, the goose 10.7 pounds, and the young goose 7.8 pounds. The geese produced 1.15 pounds of feathers which were valued at 54 cents a pound. An average yield of 16.3 eggs was obtained, of which about two-thirds were hatched under geese and the rest under hens. The breeding stock were mated either in pairs or in trios of one gander with two geese, with an average mating of two males to three females. Three-fourths of the geese were marketed alive at an average price of 76 cents, giving a profit of 49 cents. The selling price and the profit reported by farmers who produced geese only or largely for sale as breeding stock were considerably greater than those reported for market stock.

*Reports from the North and West.* Pure-bred geese were kept very largely in the Northern, Central and Pacific Coast States, as shown by the reports, although some common geese were reported from most of them. The Toulouse and Embden were by far the most popular breeds. Less than half of the breeders reported that they picked feathers from the live geese. Most breeders picked the geese only once or twice and then only during warm weather. In the average for these states, the gander weighed 17.7, the goose 15.2 and the young goose 13.2 pounds. The geese produced an average of 1.11 pounds of feathers valued at 69 cents a pound. The average egg production was 26.7 of which slightly more than half were hatched under hens. Three-fifths of the geese were marketed alive and brought an average price of \$1.82 and a profit at \$1.16 each.



839 - On the Factors Governing the Sex of the Eggs of the Honey-bee. — MORGEN-  
THALER, OTTO, in *Bulletin de la Société romande d'Apiculture*, Year 14, No. 2,  
pp. 35-39. Lausanne, 1917.

The writer remarks the curious coincidence by which two workers, M. BOURGEOIS and Prof. GÖLDI of the University of Berne, by entirely different routes, should have reached the same conclusions with regard to the sex of the eggs of the bee.

Since the researches of DIERZON, that is to say, since the middle of the 19th. century, we know that unfertilised eggs give rise to males and fertilised eggs to females (queens and workers). Several theories have been made as to the manner in which the eggs are fertilised. The one most in favour up to the present is that which states that the queen can open or shut the seminal vesicle containing the sperm and thus fertilise the egg passing along the oviduct at will. Another theory supposes a mechanical action depending upon the position the queen adopts in laying an egg in a male or worker cell: the latter, being narrower than the others would exercise pressure upon the abdomen of the queen, thus causing fertilisation of the egg. The latest theory, that of DIEKEL, claims that the queen only lays fertilised eggs: it is the workers themselves who determine what the sex is to be by means of glandular secretion; thus, the eggs laid in the drone cells would be treated with a "male secretion" and the eggs laid in the worker cells with a "female secretion".

According to this theory, however, there would be 2 kinds of males: those from eggs laid by an unfertilised queen (owing to a unsuccessful nuptial flight or inability of the queen to emerge) and those from fertilised eggs treated with the male secretion of the workers. But such a thing has never been observed; besides, microscopic examination has shown that the sperm plays no part whatever in the development of the males, which tends to establish the fact that, in a normal colony, the drones are derived from unfertilised eggs.

According to BOURGEOIS, "monopoly of sex belongs exclusively to the young nurse bees and not to the queen". The queen only lays fertilised eggs; the workers, if they require males, act upon a fertilised egg (female) by some unknown means in such a way as to suppress a sexual particle, thus "defertilising" it.

GÖLDI, during a long stay in the tropics, has observed the development and mode of life of social insects.

His conclusions are as follows: "In view of what I have been able to observe among insects, especially ants, I am induced to believe that what occurs in the hive must correspond with the laws formally observed in other insects. And I am inclined to think as follows: the whole of the eggs laid by the fertilised queen are provided with seminal matter. A seminal filament penetrates the egg which is to give birth to a female, whereas in the case of the egg which is to produce a male the workers prevent this filament from entering. This operation would be effected in the following way: the micropyle (through which the filament would penetrate) is closed by the workers, or else, by means of a special secretion, they kill the seminal thread".

As will be seen, the sum-total of these views is the same as that reached by BOURGEOIS. The writer remarks that, as according to this interesting theory, the workers must enter the male cell every time an egg is laid therein, it would be interesting to confirm experimentally whether this actually occurs in practice.

## FARM ENGINEERING.

840 - **The Benedetti Double Brabant Motorplough.** — DESSAISAI, R., in *Journal d'Agriculture pratique*, Year 81, No. 8, p. 145, fig. 2. Paris, April 19, 1917.

Description of a small double-brabant motorplough, built by M. Benedetti, at Grambois (Vaucluse), France.

The plough is intended for use on medium size farms, for the cultivation of drilled crops, vines or shrubs planted in lines, also for ploughing, etc.

AGRICULTURAL  
MACHINERY  
AND  
IMPLEMENTS



The **BENEDETTI** Double Brabant Motorplough.

As shown in the figure, the chassis is carried on two driving-wheels, on whose tyres land-grips can be fixed for field work. In front are the fan-cooled radiator, the 2 cylinder, 10-14 H.P. engine under the hood, and the tank fixed to the mud-guard. Behind, the chassis is attached to the turning beam of the 3 furrow double brabant plough, the end of which is supported by a large furrow-wheel, near which is the handle controlling the swinging movement. The coupling is by a springlock movement; vertical adjustments are made by the usual system on double-brabant ploughs. A large lever controls the various movements.

The distance between the wheels can be modified according to requirements, so that the land-wheel always runs in the furrow opened on the previous turn. The total weight is 1540 lbs., the machine being able to turn in a circle of 3-foot radius. The present price is 6 800 francs.



841 — **Mechanical Methods of Cultivation of Vineyards.** — RINGELMAN, MAX, in *Bulletin de la Société d'Encouragement pour l'Industrie Nationale*, Vol. 127, No. 3, pp. 599-602, Paris, May-June, 1917.

French vineyards occupy about 1 600 000 hectares (1) of which 640 000 hectares (not including those in Algeria) are cultivated with the aid of draught animals, particularly horses and mules. Before the war, the annual cost of these animals on some farms was from 800 to 1200 fr.

One can reckon that it requires 1 horse per 6 hectares of vines in an average-sized vineyard or per 8 hectares in a large one. In this latter case one must allow for a supplementary animal per 20 to 24 hectares of vines.

Several years before the war, wine-growers were demanding mechanical methods of cultivation capable of doing such work as ploughing to a depth of from 0.10 metre to 0.15 m.; scarifying to a depth of 0.05 m. and of being utilised also for various kinds of work, such as sulphating, dusting, carting, etc. The market for these machines should encourage inventors and makers to work out the best conditions for the application of mechanical methods in a given number of vineyards, as it would be wrong to attempt to construct a single type for all kinds of work.

In order to show the importance mechanical methods of vine cultivation are capable of attaining in the near future, it is sufficient to remember that :

3 departments possess vineyards with an area of over										100 000 hectares	
4	»	»	»	»	»	»	»	»	50 to	70 000	»
13	»	»	»	»	»	»	»	»	25 to	50 000	»
6	»	»	»	»	»	»	»	»	20 to	25 000	»

Undoubtedly, not all of these areas mean the employment of mechanical cultivators owing to the method of plantation, length of rows, width of furrows, slopes steeper than 5 %. With the application of mechanical cultivation one can foresee the suppression of ploughing and the use of the cultivator instead (2)

During the last 10 years, excellent results have been obtained with superficial cultivation applied to a vineyard of 70 hectares of the Var, on very clayey soil of low fertility, stony in parts and liable to drought. With this method (3), the two ploughings are suppressed and replaced by 5 or 6 scarifyings. In 1916, the crop gave a little over 100 hl. of wine per hectare.

Thus, instead of 6 to 8 day's work required for the 2 ploughings of a

(1) 1 hectare = 2.4711 acres. (2) Attention has been devoted to this method of cultivation for some time past. Experiments have been made in Alsace, at the National School of Montpellier, in the South, Algeria, etc. (Ed.)

(3) See B. 1914, No. 640 and R. July 1917, No. 640. (Ed.)



hectare, all that is required is 5 to 6 days of scarifying spread over a much longer period.

In the Var, a Pilter hoe, covering a width of 1.50 metres, drawn by a small Avery tractor, scarified an hectare of vines in from 5 to 5 1/2 hours. Other experiments with tractors are also recorded.

In view of the lack of hands, draught animals, and of the increase in the price of feeds and upkeep for these animals, the very existence of vineyards is threatened and it is easy to guess the situation might be worsened by events of another nature also.

There is, therefore, every interest in hastening the solution of the problems pertaining to mechanical cultivation of vineyards of which the main points might be summarised as follows :

- 1) The over-all width of the apparatus must not exceed 1 metre ;
- 2) The apparatus, with plough or cultivator, must be able to return in the same interline, or in one of the neighbouring interlines, while turning on a headland which must not exceed 3 metres.

This programme is not exhaustive and encouragement should be given to constructors of apparatus for the mechanical cultivation of vines on slopes and planted at close intervals.

Attention should also be directed to training professional mechanics to act as instructors to drivers of mechanical cultivators.

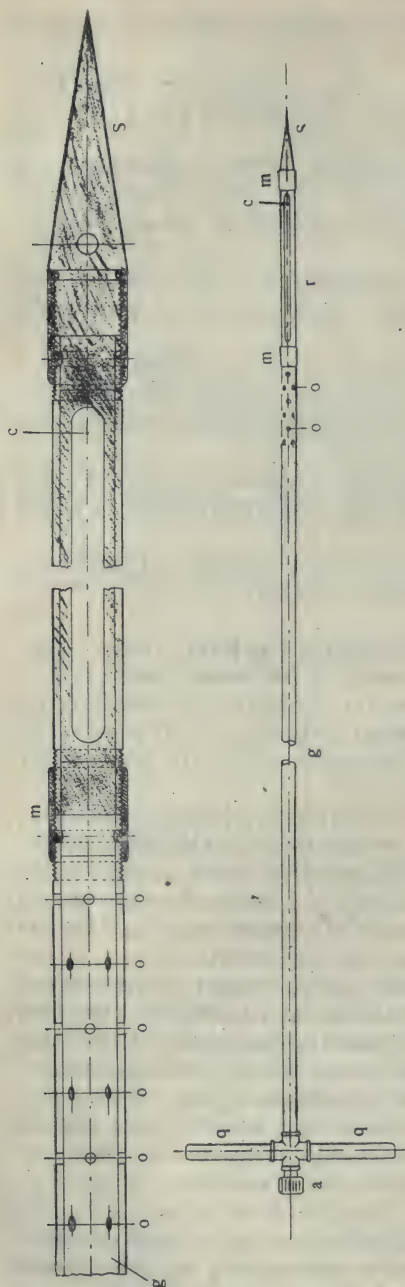
842 - **Apparatus to Prevent Spontaneous Combustion of Hay Ricks.** — FORDI, ERNST, in *Deutsche Landwirtschaftliche Presse*, Year 44, No. 49, p. 388. Berlin, June 20, 1917.

The solid appliances at present in use for preventing the spontaneous combustion of stacks of hay, or of other forage, do not permit of the introduction into the stack of extinguishers at the points where the temperature might be nearing the danger point.

After having established the points where the temperature was rising the stacks used to be soaked with water, which rendered the forage practically useless. The writer describes an apparatus, of which an illustration is appended, which remedies the above drawbacks and enables the temperature in the stack to be controlled, by means of a thermometer and the use of extinguishing liquids in case of spontaneous combustion.

The apparatus consists of a tube for the escape of gases *g*, with a thread *a* on the outside for screwing on a flexible tube and below, on the inner side of this thread, two transverse arms *q* about 40 cms long ; at the other end is screwed on a point *s* about 18 cms. long. The whole apparatus is about 3 metres in length ; the tube *g* is of 3/4 inch gas piping. Acting as a continuation of the point *s* is a removeable piece *r*, about 34 cms. long, of which the hollow can be fitted with a maximum thermometer. The portion *r* can be removed and the point *s* (perforated transversely in order to allow of screwing or unscrewing without difficulty) fixed directly on to the tube *g*. The part *s* and the part *r* with the thermometer are both provided with sleeves *m*, screwed and riveted and furnished with an inner thread by means of which the parts *g*, *r* and *s* can be fitted to one another.

The extremity of the part *g*, connected with the pieces *r* and *s*, is per-



Apparatus to Prevent Spontaneous Combustion  
of Hay Ricks.

forated for 15 cms. of its length with 24 small openings 0,4 mm. in diameter, arranged regularly about the circumference of the tube g.

The apparatus possesses the following advantages.

1) It enables the temperature in the stack to be read.

2) It allows of the use, when the temperature reaches a dangerous height, of any method of extinguishing known, in order to prevent spontaneous combustion. There is consequently less amount of spoilt fodder and the method is simpler in every way.

3) By using several of these devices sufficient ventilation can be obtained to carry off the dangerous gases which develop inside the stack.

4) With the solid devices employed at present, taking the temperature is an exceedingly dangerous operation, for, at the movement of their withdrawal, the gases are capable of igniting. The apparatus described above allows of the introduction into the stack of extinguishers and so prevents fires.

For working inside barns a collapsible apparatus has been devised consisting of 2 pieces each 1.50 m. long: after the first piece has been dug into the stack the second is screwed into it and the apparatus is then pushed home.

When fermentation has already begun, several instruments are used of big calibre in order to obtain sufficient ventilation. In order to control the temperature, a single thermometer is used which can be introduced and withdrawn by means of a shaft.

The FORDI apparatus is patented in Switzerland under N° 74 504.

843 - **Making Milk Bottles of Paper.** — I. *Scientific American*, Vol. XCVI, No. 11, p. 275, 3 figs. New York, March 17, 1917. — II. *Les Inventions Illustrées*, No. 6, pp. 8-9. Paris, June, 1917.

Doctors and health experts in the United States condemn the glass milk bottle as a pernicious germ-carrier. They are demanding that destructible bottles be used for the distribution of milk for the home, so that they cannot be returned to the dairy to be refilled and sent out another time laden, perhaps, with germs picked up during previous use. Pennsylvania was the first state to proscribe the use of the glass bottle as being a continual menace to the public health.

Some dairies of the progressive type had already begun to employ destructible bottles made of light cardboard coated with paraffin. Milk can be kept in a fresh condition in these paper bottles many hours longer than in the glass bottles, being both air and light tight.

A machine has been invented capable of manufacturing paper milk bottles at the rate of 5000 an hour. It is 90 feet long and costs over 15 000 dollars. Wood pulp is the raw material employed. The process does not require exclusively high-priced paper pulp; any fibrous wood is said to work equally well. One ton of pulp will produce 60 000 bottles. Owing to the low cost of manufacture the new paper bottle is said to be cheaper in the long run than the common glass bottles in use at the present time. Only 3 men are required to work the machine, and from beginning to end the milk bottle is handled only by steel fingers, so that the apparatus meets all sanitary requirements.

The process of manufacture is simple. A steel core is dipped into a tank of raw pulp and, by means of 4 clamps, the pulp is pressed round the core into a seamless bottle. During this operation the bottle revolves three times, the clamps pressing at every third of a turn.

The bottle next passes through a powerful drier and over a stencil which prints on it the name of the milk dealer, the capacity of the bottle, etc. It is then removed from the core by a steel hand and deposited to a belt conveyor which crimps on the bottom and the top. The bottle is then given a paraffin bath that renders it impervious to liquid or acid and is automatically packed in dust-proof cartons for delivery to the dealer.

The operation is continuous and it takes about 8 minutes to convert the raw pulp into the completed bottle.

#### 844 - **Review of Patents.**

##### *Tillage Machines and Implements.*

Canada	175 993. Plough mechanism.
United Kingdom	106 162. Turf-cutting machine. 106 515. Cultivating implement. 106 551. Spades, forks, for disabled men.
United States	1 227 745 — 1 229 354 — 1 231 225 — 1 231 237 Ploughs. 1 227 938 — 1 228 273. Agricultural implements. 1 228 134. Tractor plough and cultivator. 1 228 695. Disk mounting for plough. 1 229 110. Cultivator.



- I 229 157. Three wheeled cultivator.
- I 229 488. Coil spring seat for disks.
- I 229 868. Earthworking implement.
- I 229 970 — I 230 243. Cultivator attachments.
- I 230 022. Sweep stock attachment.
- I 230 084. Plough-guide.
- I 230 194. Harrow.
- I 230 261. Tilling machine.
- I 230 339. Power plough.
- I 230 716. Disk harrow cleaner.
- I 231 352. Power driven cultivator.
- I 231 398. Harrow.
- I 231 502. Cotton chopper.

*Manures and Manure Distributors.*

- United States I 227 701 — I 230 069 — I 231 199. Fertiliser distributors.

*Drills and Seeding Machines, etc.*

- Switzerland 75 525. Seeder attachment.
- United States I 228 682. Gage wheel attachment for planters.
- I 229 158 — I 231 398. Planters.
- I 229 604 — I 229 988. Maize planters.
- I 229 941. Check row planter.
- I 230 350. Peanut planter.
- I 230 465. Potato planter.
- I 230 806. Plant setting machine.

*Various Cultural Operations.*

- Canada 176 094. Hoe for weeding.
- Switzerland 75 412. Electrocultural process and installation used also for destroying parasites and locusts.
- United States I 228 935. Weeder.
- I 228 992. Hocking machine.
- I 229 355. Lister cultivator.

*Reapers, Mowers and Harvesting Machines.*

- Canada 175 694. Harvester, thresher, etc.
- United Kingdom 105 983. Gathering fruit.
- 106 105. Sweeping lawns, etc.
- United States I 228 238. — I 229 598. Cotton picking machine.
- I 228 403. Mower knife sharpener.
- I 228 971. Maize husker, ensilage cutter and silo filler.
- I 229 000. Mowing machine.
- I 230 127. Hay mowing apparatus.
- I 230 822. Pea harvesting machine.
- I 230 863. Horse hay-rake.
- I 231 174. Sickle bar.
- I 231 195. Shocking machine.

*Machine for Lifting Root Crops.*

- Canada 175 841. Potato digger.
- United Kingdom 106 341. Potato diggers and harvesters.

- United States I 228 562. Peanut digger.  
I 229 372. Potato digger and pulverizer.

*Threshing machines.*

- United States I 229 063. Thresher or separator.

*Machines and Implements for the Preparation and Storage of Grain, Fodder, etc.*

- Canada I 75 774. Grain tank.  
I 75 835. Shock gatherer.  
I 76 536. Bag jolter.  
I 76 542. Tire securing device.
- Switzerland I 75 408. Green fodder press.  
I 75 409. Device for preventing spontaneous burning of hay stacks.  
I 75 410. Green maize silo and press.
- United Kingdom I 106 014. Hand propelled vehicles for goods.  
I 106 565. Hay elevators.
- United States I 227 761 — I 231 354. Hay press.  
I 229 031. Hay stackers.  
I 229 036. Hay handling device.  
I 229 126. Baling press.  
I 229 640. Hay loader.  
I 230 066. Hay rake or stacker.

*Forestry.*

- United Kingdom I 106 557. Sawing.

*Traction and Steering of Agricultural Machinery.*

- Canada I 176 339. Motor tractor.  
I 176 458. Hitch.
- United Kingdom I 106 648. Traction engines.
- United States I 227 576. Universal tractor.  
I 227 630 — I 230 014 — I 230 340 — I 230 430 — I 230 655 — I 231 408.
- Tractors.*
- I 228 024 — I 228 895 — I 229 210. Tractor wheels.  
I 228 306. Motor tractor.  
I 228 377. Automatic steering-gear for tractors and the like.  
I 228 688. Caterpillar tractor.  
I 228 709 — I 229 462. Traction engines.  
I 229 865. Control mechanism for tractors and the like.  
I 230 294. Draft evener for harrows.  
I 230 539. Steering mechanism for tillage implements.  
I 230 648. Operating mechanism for tractors.

*Housing of Livestock.*

- United Kingdom I 106 007. Disinfectant.  
I 106 012. Destroying insects.  
I 106 644. Making horseshoes.
- United States I 229 094 — I 229 435. Hog oilers.

*Aviculture.*

- United Kingdom I 106 117. Temperature alarms.  
I 106 218. Crates for eggs, etc.  
I 106 405. Boxes for eggs.

*Industries Depending on Plant Products.*

- Brazil 9 988. New heating and cooling apparatus for rapid heating of alcoholised wines and means of handling.
- Canada 175 940. Apple slicer.  
176 317. Method for decorticating flax.
- United Kingdom 106 479. Vinegar vat.  
106 513. Yeast for bread making.  
106 642. Distilling and evaporating liquids.

*Dairying.*

- Canada 175 463. Rennet.  
175 633. Sterilizing apparatus.  
175 712. Milk preparation.  
176 311. Teat cup.
- Switzerland 75 444. Butter-tub.
- United Kingdom 106 048. Storing bottles, cans, etc.  
106 200. Boxes,

*Farm Buildings.*

- Canada 175 682. Gate.  
176 081. Window holder and lock.  
176 591. Grain elevator.  
176 644. Wire stretcher.
- Switzerland 75 411. Hothouse.
- United Kingdom 106 368. Fence post.
- United States 1 227 928. Silo construction.

*Various.*

- 175 777. Harness.
- Canada 176 226. Oil car.
- United Kingdom 106 512 — 106 514. Filters.  
106 564. Cooking and like apparatus.

FARM  
BUILDINGS

**845 — Equipment for Farm Sheep Raising.** — MACWHORTER, V. O., in *United States Dept. of Agriculture Farmers' Bulletin* No. 810, 27 pp., 37 figs. Washington, D. C., June 1917.

The object of this publication is to furnish a practical guide for equipping farms for sheep raising. Owing to the wide differences in climatic conditions it is not possible to suggest a particular type of building for all parts of the United States.

The above bulletin contains numerous plans of buildings, some showing combinations to contain horses, cattle, sheep, etc., others intended for sheep only; at the same time scope is left for private initiative to choose the building which is best suited to the particular conditions of the farm in question. Equipment for raising sheep is not expensive. In mild latitudes little housing is required, and the main need is for fencing and pastures of sufficient number and size to allow frequent changing of flocks to fresh ground to insure health. For enclosing sheep pastures and lots a fence that will exclude dogs should be used. The dog-proof fence should be 57 inches high, the posts  $7\frac{1}{2}$  feet long, set  $2\frac{1}{2}$  feet in the ground. Close to the ground should be set a tightly stretched barb wire, next to which is a 36 inch woven-wire fence with 4-inch mesh and above this 3 strands of barbed wire. Portable hurdles are illustrated and described.



When winters are longer and more severe, buildings and sheds are necessary to furnish protection from storms, though no special provisions are needed for warmth. Dryness, good ventilation and freedom from draughts are the first requisites of buildings for sheep.

Convenience in feeding and shepherding must also be held in mind in locating and planning such buildings or sheds. Abundance of light is necessary for the health of the sheep.

One square foot of window for each 20 square feet of floor space is necessary. Small flocks can be cared for in sections of barns having stabling or feed storage for other stock, but with a flock, of say, 100 ewes, separate buildings are desirable. The interior arrangements of these buildings should be such as to require a minimum of labour and the least possible moving of the ewes in doing the feeding and caring for them during the lambing season. Ample yard space that is dry and sheltered should be available adjacent to the main barn or shed.

Level and well drained clay-surfaced floors are satisfactory and economical. Concrete floors for alleys and feed rooms are necessary, but it will seldom be called for in the pens.

Instructions are given for the construction of feed racks, wooden grain troughs, etc ; some fixed and others with moveable parts or completely portable and the same with automatic feeding arrangements. The descriptions are accompanied by very clear drawings giving all necessary dimensions.

A list is appended to the bulletin containing references to all the publications of the U. S. Dept. of Agriculture relating to sheep raising.

## RURAL ECONOMICS.

846 -- **The Utilisation of the Profits made by Swiss Peasants.** — LAUR, ERNST, in *Archiv für exakte Wirtschaftsforschung*, Vol. 8, Pt. 3, pp. 367-385. Jena, 1917.

Efforts to improve the condition of agriculture by increasing the price of products are frequently met with the reproach that any increase of income which may result will only have the effect of raising the price of property, so that an increase in the price of products will do more harm than good to the farmer and his descendants. If this be really so, the effect would be noticeable first of all in the use to which the farmer puts his profits.

Taking agricultural accounts as his basis, the author has examined the placing of the profits of the Swiss peasant. This investigation was made during the war, a fact which must be borne in mind when considering the results ; it is to be continued. The accounts of 241 Swiss farms were used ; these had been submitted in 1915-16 (from March 1 to February 29) to the control of the Swiss Peasant's Society.

Table I gives the most important results of the final accounts, calculated since 1901 ; they are classified according to the size of the farm and give information as to the profits realised.

The 3 267 accounts examined showed an average profit of £188 per

TABLE I. — *Profits realised on Swiss farms.*

Year	Number of ledger	Total income	Income of estate and household	Expenditure	Change in income	
					Total	After deduction of income from dependent branches
1) Small farms (7 to 12 acres)						
		£. s. d.	£. s. d.	£. s. d.	£. s. d.	£. s. d.
1901-05	76	98 15 11 1/2	79 9 6	83 12 8	+ 15 6 5	— 4 3 2 1/2
1906-13	236	112 7 0	81 14 10 1/2	88 9 3	+ 23 17 0	— 6 15 5
1914-15	48	116 7 9 1/2	94 12 11	91 9 8	+ 24 19 2	+ 3 4 2 1/2
1901-15	360	108 7 4 1/2	82 13 7 1/2	87 5 0	+ 21 2 5	+ 4 11 5
2) Small peasant farms (12 to 25 acres)						
1901-05	232	140 4 7 1/2	112 6 2	107 11 2	+ 32 19 10	+ 4 14 11
1906-13	889	157 19 9	130 11 8	115 2 6	+ 42 17 3	+ 15 15 6 1/2
1914-15	223	175 0 11 1/2	154 11 6 1/2	122 5 11 1/2	+ 52 14 11 1/2	+ 31 11 6 1/2
1901-15	1344	154 7 8 1/2	127 9 9 1/2	113 2 0 1/2	+ 40 15 9	+ 14 4 2
3) Peasant farms (25 to 37 acres)						
1901-05	175	178 1 0	155 10 3 1/2	130 18 6 1/2	+ 48 2 5	+ 20 11 9
1906-13	478	213 3 8 1/2	171 10 3 1/2	141 5 2 1/2	+ 62 3 10	+ 30 11 8 1/2
1914-15	124	249 0 9	222 4 5 1/2	154 5 6	+ 86 0 8	+ 68 4 4
1901-15	777	200 19 10	171 4 4	139 4 6	+ 62 1 8	+ 22 6 2
4) Large peasant farms (37 to 74 acres)						
1901-05	148	224 14 0	185 0 9 1/2	167 18 3 1/2	+ 56 15 5 1/2	+ 17 2 5
1906-13	364	266 0 11	223 0 5	163 1 11 1/2	+ 102 18 11 1/2	+ 60 5 0 1/2
1914-15	96	292 16 9	267 1 2 1/2	164 17 4	+ 127 19 5 1/2	+ 102 3 11
1901-15	608	255 15 6	216 4 5	164 18 9	+ 90 16 8	+ 51 5 7 1/2
5) Large farms (74 to 173 acres)						
1901-05	31	269 4 1 1/2	244 13 2	157 12 4 1/2	+ 112 5 7	+ 87 8 0 1/2
1906-13	114	326 6 1 1/2	293 19 6	206 5 11 1/2	+ 117 15 8	+ 87 13 6
1914-15	33	398 12 10	385 2 7 1/2	232 6 6	+ 166 12 7 1/2	+ 153 2 6 1/2
1901-15	178	315 10 8 1/2	289 13 4	183 12 10 1/2	+ 121 18 1	+ 96 7 1
6) Averages						
1901-05	662	170 16 10	141 18 1	126 11 10 1/2	+ 44 5 0	+ 15 6 3
1906-13	2081	190 18 1 1/2	159 5 5 1/2	131 7 7	+ 59 10 6	+ 28 4 2 1/2
1914-15	524	224 8 0 1/2	199 18 6	141 16 11 1/2	+ 81 11 2	+ 58 8 1
1901-15	3267	180 11 9	158 16 9 1/2	131 5 4	+ 57 8 3	+ 27 19 7

farm; £30 represent the income from dependent enterprises. The expenditure did not quite amount to £131.10.0, so that about £56.10.0 (30 % of the income) were saved. The years 1901 and 1913 were the worst, the years 1912 and 1915 the best. As for the two years of war, 1914 and 1915, the first was slightly below the average. On an average, during the two years

of war, the Swiss peasants did not even make £29 more than the average from 1911 to 1915. If it be considered that these figures do not include the decrease of fertilising elements in the soil, and that 1915 was a very good year, it cannot be said that the Swiss peasants have made large war profits.

The investigations into the use of the profits, made only for 1915-16, did not include all the farms, as the author no longer had the books of some farms and on others exceptional conditions (inheritances, etc.) made comparison difficult. For this reason the average figures do not coincide exactly with those of Table I.

The peasant's profits are derived either from the farm or dependent enterprises; he uses them, partly for new acquisitions on his farm, partly in the dependent enterprises, and partly for household goods. The figures given do not show the objects bought, but only the change in stock. Amortizations, the year's losses and sales are placed apart from the new acquisitions.

Table II shows the total change in the net income (minus debts still to be received) in the four accounts, estate, household, dependent enterprises and expenditure.

TABLE II. — *Total change in net income (averages of all the farms).*

Number of farms	Change in net income in 1915-1916				
	Estate	Household	Dependent branches	Private expenditure	Total income
<i>Amount per farm.</i>					
241	£ 76.13.10	£ 2.10.1	£ 32.9.7 1/2	£ 0.11.6	£ 112.5.0 1/2
<i>Percentage of income.</i>					
241	68.68 %	2.20 %	28.62 %	0.50 %	100

About  $\frac{2}{3}$  of the profits were either re-invested in the estate, or used to pay off the outstanding debts on the estate. A little less than  $\frac{3}{10}$  were put into the dependent branches, and the rest went to the household (kitchen) and private expenditure.

Table III shows the different uses to which the income was put in percentage of the estate.

It is characteristic that a minimum part (not even  $\frac{1}{10}$ ) of the profits was invested in *land*. The money invested in *improvements* rose by about 1 %, that invested in *buildings* was even reduced, probably by regular amortizations or lack of buildings. A slight increase is noticed for capital invested in *fruit-trees*. The decrease in capital invested in *vines* proves that, during the war, and in spite of the relatively good wine harvest of 1915, Swiss farmers continued to pull up the vines. The reduction in the capital invested in *standing trees* may be explained by the absence of imported foreign wood and the large exportation of Swiss wood. The increased capital placed in *crops* is due to the fact that, in 1915-16, the farmers spent rather



TABLE III. — *Distribution of the income in percentage of the estate.*

Capital	Small farms %	Small peasant farms %	Peasant farms %	Large peasant farms %	Large farms %	Average %
Land . . . . .	35.38	10.93	4.92	8.14	1.74	8.86
Improvement . . . . .	1.55	0.77	1.28	0.49	1.27	0.89
Building . . . . .	— 13.45	9.18	— 6.85	— 3.28	— 5.77	— 0.63
Fruit trees . . . . .	— 0.77	1.43	0.08	— 0.18	— 0.08	— 0.59
Vines . . . . .	— 0.49	— 0.17	— 1.03	— 0.07	—	— 0.32
Standing trees . . . . .	— 2.12	0.93	3.82	—	— 19.27	— 1.01
Crops . . . . .	— 0.26	0.82	0.51	0.19	0.67	0.63
Plantations . . . . .	— 3.12	3.01	4.28	— 0.06	— 18.68	— 0.21
<i>Estate capital</i> . . . . .	<b>20.36</b>	<b>23.89</b>	<b>3.63</b>	<b>5.29</b>	<b>— 21.44</b>	<b>8.91</b>
Cattle . . . . .	37.40	31.63	42.65	51.01	61.83	43.29
Implements and machinery . . . . .	3.47	0.87	4.76	— 0.12	— 0.59	1.39
Stock in hand . . . . .	20.27	4.26	8.43	9.58	5.45	7.57
Money { Cash in hand . . . . .	5.08	4.60	14.41	22.27	0.56	11.56
Debts . . . . .	4.44	4.28	8.50	5.46	26.94	8.00
<i>Farm capital</i> . . . . .	<b>70.66</b>	<b>45.64</b>	<b>78.75</b>	<b>88.20</b>	<b>94.19</b>	<b>71.81</b>
WORKING CAPITAL . . . . .	<b>91.02</b>	<b>69.53</b>	<b>82.38</b>	<b>93.49</b>	<b>72.75</b>	<b>80.72</b>
Mortgages . . . . .	6.88	22.42	15.96	8.96	35.48	17.74
Contract debts . . . . .	2.10	8.05	1.66	— 2.45	— 8.23	1.54
RESERVE CAPITAL . . . . .	<b>8.98</b>	<b>30.47</b>	<b>17.62</b>	<b>6.51</b>	<b>27.25</b>	<b>19.28</b>
TOTAL INCOME OF FARM . . . . .	<b>100.00</b>	<b>100.00</b>	<b>100.00</b>	<b>100.00</b>	<b>100.00</b>	<b>100.00</b>

+ = Increase in working or decrease in reserve capital.  
 — = Decrease in working or increase in reserve capital.

more money on artificial manures than in the first year of the war. (The *crop* account only includes the cost of artificial manures for the following harvest).

The total increase in the *estate* capital represents 9 % of the profits invested in the farm. This percentage was probably higher before the war, but these and other figures seem to show that farmers use the smallest part of their profits for increasing their estate capital.

Of all the capitals, that invested in *cattle* (live-stock) has increased most ; this is in agreement with the fact that, for some years past, capital invested in cattle has shown an increase on controlled farms ; the cattle censuses confirm this result. This seems to prove that the Swiss peasant invests his profits principally in live-stock. It is not the estate capital which has been increased by the profits, but the most important part of the farm capital.

*Implements and machinery* show a slight increase, but the increase in *stock in hand* is greater ; this is partly due to a good harvest year, but chiefly to the higher price of many products. The increase in *debts* may probably be accounted for in the same way. The increase in *cash in hand* arises from better results obtained from the farm, and, above all, from the fact that, during the war, the peasants keep more money by them.

More than  $\frac{7}{10}$  of the total profits placed in agriculture come under the heading of *farm capital*, and are 8 times greater than those placed in the land and estate.

Of the profits invested in agriculture,  $\frac{4}{5}$  are used for new farming implements and  $\frac{1}{5}$  only for paying off debts.

The influence of the size of the farm on the utilisation of the profits is then discussed. In so far as any conclusion may be drawn from the number of farms examined it may be said that : The smaller the farm the greater the amount of profits used to buy land. No influence is discernible on the *improvements capital* or the *building-capital*. As far as the *plantations* are concerned, the *standing trees* are only influenced by the size of the farm. The profits invested in *live-stock* also increase with the size of the farm. The figures for *implements and machinery* are not very consistent, but it may be said that small farmers complete their stock with their profits, whereas large farmers buy less. The size of the farm seems to have no influence on the other groups of *farm capital*, or on the *amortization of debts*.

The distribution of the income in percentage of the working and reserve capital of the *household* is as follows (in averages) :

Live stock (farm-yard) . . . . .	6.39 %
Dead stock, . . . . .	13.60 %
Stock in hand (provisions) . . . . .	63.94 %
<hr/>	
Total working capital . . . . .	83.93 %
Reserve capital . . . . .	16.07 %
<hr/>	
Net household income . . . . .	100.00 %

The greater part of the increase in income concerns the stock in hand ; this is partly the result of variations in price, but it also proves that, during

the war, the peasants show a tendency to assure their provisions by sufficient quantities of stock in hand.

The average change in the income invested in *dependent branches* is as follows :

Investments in non-agricultural enterprises . . . . .	4.01 %
Bonds, shares, money placed in saving banks. . . . .	90.06 %
<hr/>	
<i>Total working capital</i> . . . . .	<b>94.07 %</b>
<i>Reserve capital</i> . . . . .	<b>5.93 %</b>
<hr/>	
<i>Net income of dependent branches</i> . . . . .	<b>100.00 %</b>

The investment of profits under the form of deeds or in saving banks increases with the size of the farm.

The *expenditure income* cannot be called a capital because it is not used to acquire goods ; nevertheless certain parts of it have today the character of capital. However this may be, it is necessary to consider it when estimating a man's economic position, and the Peasant's Society ask to have it included in the accounts studied. The average percentage of the change in income is :

Working capital . . . . .	105.15 %
Reserve capital . . . . .	→ 5.15 %
<hr/>	
<i>Net expenditure income</i> . . . . .	<b>100.00 %</b>

The actual figures per farm are exceedingly small. The favourable condition of the market has not caused the peasants to spend large sums on their homes, dress or articles of luxury.

CONCLUSIONS: This study shows how great is the thrift natural to the agricultural population. Although the agricultural income, including wages and interest on capital, reached, during the years 1901-1915, an average of 4/— per day per man, and that the average dependent income did not exceed £29.15.0 per year per family, the Swiss peasant families managed to save an average of £57.3.8 a year. In 1916, the agricultural income rose to 6/— per day's work, the dependent income was only £20.16.0, and yet an average sum of £107.6.4 per farm was saved.

On an average the profits made were used up as follows :



## I. ESTATE:

Land . . . . .	6.09 %
Improvements . . . . .	0.61
Buildings . . . . .	— 0.44
Fruit trees . . . . .	0.41
Vines . . . . .	— 0.22
Standing trees . . . . .	— 0.69
Crops . . . . .	0.36

Total: Estate capital . . . . . **6.12 %**

Live stock . . . . .	29.72 %
Implements and machinery . . . . .	0.96
Provisions . . . . .	5.21
Cash in hand . . . . .	7.94
Debts . . . . .	5.49

Total: Farm capital . . . . . **49.32 %**

Total: Working capital . . . . . **55.44 %**

Mortgages . . . . .	12.19 %
Contract debts . . . . .	1.05

Total: Reserve capital . . . . . **13.24 %**

Net income of estate . . . . . **68.68 %**

## II. HOUSEHOLD:

Live stock . . . . .	0.14 %
Utensils . . . . .	0.30
Provisions . . . . .	1.40

Total: Working capital . . . . . **1.84 %**

Reserve capital . . . . . **0.36**

Net household income . . . . . **2.20 %**

## III. DEPENDENT BRANCHES:

Investments in non-agricultural enterprises . . . . .	1.15 %
Bonds, shares, money placed in saving banks, etc. . . . .	25.77

Total: Working capital . . . . . **26.92 %**

Reserve capital . . . . . **1.70**

Net income of dependent branches . . . . . **28.62 %**

## IV. EXPENDITURE:

Working capital . . . . .	<b>0.53 %</b>
Reserve capital . . . . .	<b>— 0.03</b>

Net expenditure income . . . . . **0.50 %**

Total net income . . . . . **100.00**

Only 6 % of the total profits were invested in the estate, and about half in the farm. A little more than 13 % went to the amortization of agricultural debts. About 2 % of the profits were used to increase household stock, more than  $\frac{1}{4}$  were placed in saving-banks, shares, bonds, etc., and 0.5 % were reserved for expenditure.

## AGRICULTURAL INDUSTRIES.

INDUSTRIES  
DEPENDING  
ON PLANT  
PRODUCTS

847 - Contribution to the Study of the Aldehydes of Wine. — LABORDE, J., in *Annales de l'Institut Pasteur*, Vol. 31, No. 5, pp. 215-252. Paris, May, 1917.

In an introduction the author gives an historical study of the work done on the aldehydes of wine. He points out that the work done during the last twenty years on the presence of acetic aldehyde in fermented liquids, and particularly wine, shows that the formation and disappearance of this aldehyde may be subject to chemical and physical causes. The aldehyde may be formed by the oxidation of ordinary alcohol in contact with the air, and the phenomenon is favoured by catalytic action.

TRILLAT'S experiments show that, by virtue of their vital properties alone, the mycoderms of wine form aldehydes. According to KOTYTSCHIEW and NEUBERG, the aldehydes resulting from the splitting of the sugar by the yeast represent, during the formation of alcohol, an intermediary product which the hydrogenising influence of the medium changes as it appears. It is, however, possible for small quantities to escape this influence according to the prevailing conditions. This hydrogenising, or reducing, action leads to the supposition that a reductase, secreted by the yeasts, is present.

The aldehydes seem to play an active part in rendering the colouring matter of wine insoluble during ageing; and appear to be the cause of certain bitter tastes, especially that which corresponds to the disease of bitterness.

THE ESTIMATION OF ALDEHYDES IN WINES OR THEIR DEPOSITS. The best method is the colorimetric method with rosanilin bisulphite. It gives an inclusive but satisfactory result, because acetic aldehyde is present in much more considerable quantities than any other aldehyde product which may accompany it.

The method is as follows: 1) the aldehyde is distilled off and concentrated, if necessary, to a smaller volume, which is then brought up to a known volume by the addition of pure alcohol, so that the final standard of the alcoholic solution is 50°; 2) the quantity of aldehyde contained in this liquid is determined by the official method.

CATALYTIC PRODUCTION OF ALDEHYDES. — In his work on "*Acetic Aldehyde in Wine*", TRILLAT shows that the proportion of the aldehyde increases according to the nature of the vessel containing the wine and by contact with porous bodies, and that it varies with the temperature, nature of the walls and their degree of porosity, exposure to light and degree of acidity. Sulphurous acid favours the production of aldehydes in white wine.

These different circumstances are partly those under which wine may be stored.

The author has found the chemical phenomenon of the production of alcohol to depend much more on the nature of the wine than was shown by TRILLAT.

When wine is exposed to air it absorbs the oxygen, which combines with its various elements, thus determining the rapid formation of aldehydes. It is sufficient for the wine to absorb oxygen by a few minutes' aeration for the production of aldehydes to continue in the absence of air; if the temperature is raised, it becomes much more rapid.

There is, in wine, some favourable cause, probably of a catalytic nature, which is dependent on the actual constitution of the natural liquid. Wine may contain oxidising diastases, but, as the production of aldehydes continues after wine has been heated to 80°, a temperature which destroys the diastases, there must certainly be a purely chemical catalytic action.

The formation of aldehyde may be facilitated by 3 principal catalytic agents: 1) tannic matter, more or less combined with potassium; 2) œnoxidase; 3) the oxidase of *Botrytis cinerea*.

1) *Chemical action*. — This seems to be the most important action. In wine, tannic matter (colour and œnotannin in red wine and œnotannin alone in white wine) are always more or less combined with potassium in spite of the organic acids of the wine. This combination acts as a catalytic agent, and its influence is favoured by the particular constitution of the medium, quite independently of the presence of the oxidases.

This fact was confirmed by experiments with alcohol in which gallotannin and potassium had been dissolved in varying proportions.

a) 10 % alcoholic solutions of pure gallotannin were mostly saturated with potassium and exposed to the air. The amount of aldehyde formed at the end of 48 hours was proportional to the amount of tannin in the solution, as is shown by the following table:

Strength of the gallotannin solutions per litre grammes	Aldehyde found per litre grammes
1.00	0.0065
2.50	0.0250
5.00	0.0250
10.00	0.0470

b) In solutions in which there were 4 grammes of tannin per litre, the amount of potassium was varied (exact saturation was obtained with 1.2 cc. of normal potash per 100 cc. of tannic solution). The following results were obtained:

Volume of KOH added per litre	Oxygen absorbed per litre	Aldehyde formed per litre	Oxygen corresponding to the aldehyde
—	125 cc.	Traces	—
6 cc.	325 »	0.030 gr.	7.8 cc.
12 »	325 »	0.065 »	16.7 »
24 »	470 »	0.085 »	22.0 »

2) *Influence of the œnoxydase*. — Oœnoxydase, discovered by MARTINAND, is the oxidase of the grape; it is present in wine — as in the grape — in very small quantities.

By heating wine to 85° C. the oxidase is destroyed and the aldehydes are formed less rapidly than in natural wines; heat has an inhibitory action which is lessened after a certain time, varying with the nature of the wine, and its content in tannic matter (in white wines, which are much poorer than red wines in tannic matter, the difference, in some cases, persists almost indefinitely).

The influence of sulphurous acid when added to natural wine is usually similar to that of heating, but more intense; but equilibrium may be established after fairly prolonged aeration. By combining the two actions the formation of aldehydes may be considerably reduced.

The production of aldehydes in old wines is usually much less important than that in new wines.

3) *Influence of Botrytis cinerea*. — It seems that the oxidase of wines made from grapes attacked by grey mould and other diseases caused by *Botrytis cinerea* may be a very active agent in the formation of aldehydes because of the very energetic oxidation phenomena to which it gives rise and which bring about "*casse brune*".

In blending wines pasteurisation has the same effect as in normal wines, that is to say, it hinders the formation of aldehydes without ever entirely preventing it. In these wines, however, sulphurous acid facilitates the formation of aldehydes by preventing "*casse*".



**SPONTANEOUS LOSS OF ALDEHYDES.** — Apart from the formation of acid in wines which have absorbed oxygen from the air there are also inverse actions which cause the disappearance of the aldehydes, either formed naturally or added experimentally, if the wine is kept from contact with the air. In some cases this disappearance may proceed with fairly great intensity in contact with air, but it is more active when air is excluded.

In natural wines, the aldehydes present are the result of the formation and loss of aldehydes. This is probably due to the reductase secreted by the yeast during fermentation of the grape must. Heating the wine, by diminishing or destroying this diastase, greatly decreases the phenomenon, and the addition of sulphurous acid inhibits it completely.

Spontaneous loss of aldehydes does not affect the purity of the wine. In wines left to age first in casks, then in bottles, this loss gradually decreases, especially if sulphurous acid be added. The aldehyde is combined as aldehyde-sulphurous acid, whose physiological properties are very favourable to the keeping of the wine without hindering the development of those qualities due to ageing.

**PHYSIOLOGICAL PRODUCTION AND LOSS OF ALDEHYDES.** — Of the microorganisms in wine only those which are facultative aerobes (various yeasts) and those which are strictly aerobes (mycoderms) produce aldehydes. Certain anaerobic ferments seen to form acrolein by attacking the glycerine of the wine, but this physiological action is still insufficiently studied.

Yeasts and anaerobic microorganisms in the wine secrete reductases which can contribute to the total loss of aldehydes in the wine when kept from contact with the air, but which have no perceptible action if the aldehydes are combined with sulphurous acid.

**GENERAL CONCLUSIONS.** — Those catalytic and physiological agents producing aldehydes in wine which have been studied, chiefly influence new wines in casks, as contact with the oxygen of the air is thus more or less facilitated. But, apart from these influences which tend to increase the aldehydes, there are also inverse influences, which are at least equally important since they may cause the total loss of the aldehydes in the wine when it is kept from contact with the air. It is for this reason that only very small quantities of aldehydes are found in normally preserved red wines and that they are always combined with the sulphur dioxide resulting from sulphuring. In white wines, however, they are generally much more important because of the method of wine-making and the use of larger quantities of sulphurous acid which fix the aldehydes.

The slight production of aldehydes in normal red wines can, therefore, have no really perceptible action in the precipitation of tannic matter; in the case of blending wines, aldehydes play no part since they only form after the oxidation of this matter is very advanced. In the same way, during normal and prolonged ageing in bottles, the production of aldehyde and their influence in making the wine light, are almost nil.

Finally, the production of aldehydes, opposed by their loss, has only a temporary, but always unfavourable, influence on the bouquet of red wine in casks. It is also detrimental to white wines in the absence of sulphurous acid. Only special wines which derive some of their qualities from strong oxidation can derive any benefit from the production of aldehydes because this soon turns to the formation of acetic acid, which favours the development of the characteristic bouquet of these wines.

The study ends with a bibliography of 36 works.

848 - Contribution to the Study of Bitter Wines. — KAYSER, E., in the *Revue de Viticulture*, Year 24, Vol. XLVII, No. 1205, pp. 70-75. Paris, August 2, 1917.

At the beginning of his paper the author briefly surveys the chief work done on the bitterness of wine since PASTEUR. He calls to mind the fact that as yet nothing definite is known of the products of the bacterial action and of the causes of the disease, and that the composition of the bitter substance is little known.

In his study the author employed the usual methods; the glycerine, however, was estimated by TRILLAT's acetic ether method, the aldehyde colorimetrically with rosaniline bisulphite solution, and the tannin by COUDON's gelatine method. The ammonia was displaced with dry sodium carbonate (ROUSSEAU and MÜNTZ's method), the total ethers by saponification in the cold with potassium during 48 hours, the volatile ethers by saponification in the warm during one hour with gradual cooling. The total, fixed and volatile acids and the ethers are expressed as sulphuric acid.

Three wines were studied.

- 1) Wine I, from Plessis-Chenet (Seine-et-Oise), year 1902;
- 2) Wine II, from the same district, 1908;
- 3) Wine III, from Chambertin, 1889.

The first had a very marked bitter taste and a strong, pungent smell and was undrinkable. The third was less bitter; both were of the colour of onion skin, or even of Madeira wine, and the colouring matter was precipitated. The second was only slightly bitter, and would probably have become more so in time, but it was not sufficiently bitter to serve as a term of comparison as an almost normal wine.

A microscopic examination of the colouring matter of Wine I showed it to form round masses of the bent rods characteristic of bitterness according to PASTEUR. Wine III showed large masses of nodules of colouring matter mixed with tartar, but containing few rods. Wine II also contained rods.

#### *Composition of the 3 wines examined.*

	Quantity per litre		
	Wine I	Wine II	Wine III
Extract distilled in vacuo . . .	14.0 gr.	19.10 gr.	21.00 gr.
Extract at 100 . . . . .	10.5 "	14.85 "	16.60 "
Volume of alcohol . . . . .%	7.15°	8.20°	10.9°
Total acids . . . . .	2.303 gr.	5.07 gr.	4.92 gr.
Fixed acids . . . . .	0.470 "	3.36 "	3.51 "
Volatile acids. . . . .	1.833 "	1.71 "	1.41 "
Total tartaric acid as bitartrate	0.310 "	4.78 "	2.38 "
Total potassium as bitartrate .	4.460 "	4.18 "	6.61 "
Mineral matter . . . . .	1.800 "	1.900 "	— "
Tannin . . . . .	0.325 "	— "	— "
Total ethers . . . . .	10.210 "	1.323 "	1.007 "
Fixed ethers . . . . .	5.235 "	1.143 "	0.283 "
Volatile ethers . . . . .	5.178 "	0.180 "	0.824 "
Glycerine . . . . .	0.250 "	1.945 "	1.694 "
Aldehyde . . . . .	— "	0.0437 "	0.0025 "
Ammonia . . . . .	0.0267 "	0.006 "	0.0187 "



It is seen that Wine III, and especially Wine I, have undergone great changes : — a strong volatile acidity with decrease of fixed acid, and decrease of glycerine. There is slight excess of free tartaric acid in Wine II. The ratio between total, fixed and volatile ethers is :

	Wine I	Wine II	Wine III
Total ether			
Fixed ether	1.95	1.15	3.50
Total ether			
Volatile ether	1.98	7.30	1.20

The author had two bottles of Wine I; for some unknown reason the second bottle I<sup>a</sup> was much less bitter than the first although it had the same appearance under the microscope.

*Comparative compositions of Wines I and Ia.*

	Per litre	
	Wine I	Wine Ia
Volume of alcohol . . . . . %	7.15°	8.15°
Total acids . . . . .	2.30 gr.	5.20 gr.
Fixed acids . . . . .	0.47 »	2.35 »
Volatile acids . . . . .	1.48 »	2.85 »
Total ethers . . . . .	10.210 »	1.991 »
Fixed ethers . . . . .	5.24 »	1.44 »
Volatile ethers . . . . .	5.18 »	0.151 »
Glycerine . . . . .	0.25 »	1.510 »
Aldehyde . . . . .	— »	0.068 »

The nature of the volatile acids and volatile ethers was studied by DUCLAUX's fractionnal distillation method : — 1st. distillation — A ; liquid obtained divided into 2 ; redistillation of the first 50 ccs. distilled — a ; redistillation of the next 50 ccs. — b.

1) VOLATILE ACIDS. — It was found that, besides acetic acid, a normal product of all alcoholic fermentations, butyric acid may also be present, forming no doubt at the expense of the glycerine. Formic acid was also found in Wine III. With the help of DUCLAUX's tables the following ratios were obtained.

	Distillation A	Distillation a	Distillation b
Wine I . . . . .	1 A butyric		
	7.5 A acetic		
Wine Ia . . . . .	1 AB	1 AB	1 AB
	4.75 AA	3.25 AA	6.25 AA
Wine II . . . . .	1 AB	1 AB	
	8.77 AA	4.75 AA	
Wine III. . . . .	1 AB	1 AB	1 AB
		8.1 AA	4 AA

2) VOLATILE ETHERS : — In the very bitter Wine I, the quantity of butyric acid combined as ether is proportionately higher than the free quantity,



as compared with the acetic acid, whereas, in normal wines, the ratio  $\frac{AB}{AA}$  is much the same, whether in the free or combined state.

*Total ethers, fixed ethers (as ethyl tartrate) per litre of wine.*

	Wine I	Wine Ia	Wine II	Wine III
Total ethers . . . . .	21.92 gr.	3.35 gr.	2.778 gr.	2.12 gr.
Fixed » . . . . .	11.02 »	3.03 »	2.402 »	0.39 »
Volatile » . . . . .	9.32 »	0.272 »	0.324 »	1.48 »

**AMMONIA.** — The greatest quantity was in the two markedly bitter wines, Nos. I and III.

**ALDEHYDES.** — Estimated colorimetrically in the wine itself and in the deposit and lees in the bottles. It was not possible to estimate them in Wine I. The aldehyde content of Wines Ia and II was high as compared with that of Wine III. It was only possible to estimate the aldehydes in the lees in Wine III; 3.2 mg. were found per litre of wine, i. e. much the same quantity as in the wine itself.

*Oenological Constants.*

	Wine I	Wine Ia	Wine II	Wine III
Alcohol + acid. .	7.70	10.79	11.56	14.54
HALPHEN . . . .	0.16	0.37	0.50	0.38
Weight of alcohol				
reduced extract	5.40	6.52	4.4	5.3
Roos . . . . .	1.42	—	2.6	2.74

The author's investigations showed that the change undergone by bitter wines may be very marked, and that ordinary wines may be even more affected than Burgandy. This may be due to their slight alcohol content and the small proportion of various constituents of the wine which the micro-organism destroys more rapidly than in rich wines, where they are present in a larger quantity.

849 - **Production of Sugar in the United States and Foreign Countries.** — ELLIOT, PERRY, in *U. S. Department of Agriculture, Bulletin* No. 473, pp. 70. Washington, D. C., February 12, 1917.

The data presented in this bulletin cover the period from September 1, 1903, when the Brussels Convention came into effect, to the close of the season 1912-1913. The world's production of sugar from beet and cane, the production of the United States, and that of 37 other states and colonies (1) are examined successively.

**I. WORLD'S PRODUCTION.** — During the last 20 years the total production of beet and cane sugar throughout the world has nearly doubled, in-

(1) Hawaii, Porto Rico, Philippine Islands, Cuba, British West Indies, Mexico, Canada, Costa Rica, British Honduras, Argentina, Brazil, Peru, British Guiana, Paraguay, United Kingdom, Germany, Austria Hungary, Russia, France, Italy, Belgium, Netherlands, Spain, Denmark, Sweden, Roumania, Switzerland, British India, Java, Mauritius, Japan, Formosa, Straits Settlements, Fiji Islands, Australia, Egypt and Natal.

creasing from 11 000 000 tons (1) in 1893-94 to 20 000 000 tons in 1912-13. The averages of these two periods show an increase of 34 % for beet-sugar and 40 % for cane sugar. The increase in yield of sugar per ton of beets varies from 8 lbs. (0.4 %) in France to 40 lbs. (2 %) in Belgium. The number of beet sugar factories has decreased since 1903 in all countries except Russia and the United States. This decrease is due to the increased capacity of those factories which are still working and to the improvement of the methods employed. The annual output per factory during the 10 years ending 1912-13 was greatest in Hungary, with 17 610 tons, as against 5 312 tons for Austria and 6 615 for the Empire. For the other countries this output reached 7 585 tons for the Netherlands, 7 474 for the United States, 6 170 for Germany, 4 947 for Russia, 3 054 for France and 2 765 for Belgium. The total world area over which beet is grown exceeds 6 000 000 acres, with an average production of 1 ton of sugar per acre of beets. As the average yield of sugar per acre of cane is slightly higher than for beets it may be assumed that about an equal area of cane is harvested, which would give a total of 12 000 000 acres devoted to sugar-growing throughout the world. The yield of beet sugar per acre has varied in the different countries from 1 800 to 3 900 lbs., while the cane sugar produced per acre varies from 2 000 to more than 9 000 lbs. At Hawaii and Java the yield per acre of cane sugar is about 40 tons as against 20 tons per other countries. During the decade 1903-4 to 1912-13, 78.9 % of the world's sugar was produced by 11 countries in the following proportions: 14.5 % by British India, 13.6 % by Germany, 10.3 % by Cuba, 8 % each by Austria Hungary, Java and Russia, 4.7 % each by the United States and France, 3 % by Hawaii and 1.5 % each by Belgium and the Netherlands. During this period Germany produced 28.4 % of the beet sugar, Austria-Hungary 18.2 %, Russia 17.4 %, France 9.9 % and the United States 7.3 %. British India produced 27.9 % of the cane sugar, Cuba 19.7 %, Java 15.6 % Hawaii 5.8 % and the United States 3.9 %.

The annual exports of sugar during this period were 1 626 000 tons from Cuba, 1 342 000 from Java, 920 000 from Germany, 755 000 from Austria-Hungary and 482 000 from Hawaii.

The United States imported 2 743 000 tons as compared with 1 843 000 for the United Kingdom, 147 000 for France, 83 000 for the Netherlands, 35 000 for Argentina and 13 000 for Germany.

The consumption per head was 112.96 lbs. in Australia, 85 in the United Kingdom, 77.6 in the United States, 60.6 in Cuba, 38 in Germany, 30.6 in France, 28.1 in Belgium, 26 in Austria-Hungary, 16.7 in British India and 14.4 in Russia.

II. UNITED STATES' PRODUCTION. — 1) *Beet sugar.* The 1909 census shows the beet sugar industry to be localised in 3 groups of states.

Group I. — Arizona, California, Oregon and Washington;

Group II. — Colorado, Idaho, Kansas, Montana, Nebraska, and Utah;

(1) The ton used in this article is the short ton of 2 000 lbs.

(Ed.)



*Group III.* — Illinois, Iowa, Michigan, Minnesota, New York, Ohio and Wisconsin.

Three states in each of these groups (California, Colorado, and Michigan), together produced  $\frac{3}{4}$  of the total sugar beets on an area which, in California, rose from 41 242 acres in 1899 to 83 000 in 1909, from 40 247 acres to 112 232 in Michigan, and from 1 094 acres to 121 698 in Colorado during the same decade. The total area devoted to sugar beets during the 5 years 1901-1905 was 228 000 acres, during 1906-1910 it was 374 000 and during 1911-1915, 543 000 acres. The yield of beets per acre increased from 7.2 tons in 1899 to 10.7 tons in 1915.

The production of beet thus rose from 794 658 tons in 1899-1900 to 6 462 000 in 1915-16, representing, in this last year, a value of \$ 36 919 000; the average price rose from \$ 4.19 to \$ 5.67 per ton. The value of beets produced per acre rose from \$ 30.16 in 1899 to \$ 54.60 in 1909. In 1909 this value was exceeded by 4 other crops only: hops, tobacco, sugar cane and sweet potatoes.

In California the harvest begins at the end of July and, in the north of the central states, at the beginning of October. The average length of the season in 90 days.

The number of factories increased from 30 in 1899 to 73 in 1912, but decreased in 1914 to 60, rising to 67 in 1915. The majority of the factories have a daily slicing capacity of from 350 to 750 tons of beet. Several factories have a daily capacity of 1000 tons of beets, one a capacity of 2000 tons and one a capacity of 4 000 tons. This last factory produces from 400 to 500 tons of sugar daily.

In 1899 the factories planted, on their own land, 17.2 % of the area under beets; this figure sank to 11.4 % in 1909. In that year the beets grown in the Pacific Coast group of states had an average sugar content of 18 % those of the Rocky Mountains, 15.1 % and those of the great Lakes, 16.6 %. The capital invested in the beet sugar industry was \$ 20 141 719 in 1899, rising to \$ 129 628 938 in 1909. The quantity of beets used was 794 658 tons in 1899 and 3 965 356 tons in 1909; the sugar produced during these years passed from 81 729 to 501 682 tons, and its value increased from \$ 7 222 581 to \$ 45 937 629.

The annual average production of sugar for the ten years ending 1912-13 was 448 346 tons as against 77 202 tons for the 10 years ending 1902-03, an increase of 480.7 %.

The fuel (mostly coal) used in 1909 by these factories amounted to 575 731 tons, plus 554 174 barrels of liquid fuel. The total value of the fuel used, including rent of power, was \$ 1 899 468.

2) *Cane Sugar.* — In 1909 cane sugar was grown in 12 states over an area which increased from 386 986 acres in 1899 to 476 849 in 1909; in 1899, 72 % and in 1909 69 % of this area was in Louisiana. The area under cane in 1909 exceeded the area under beets by 112 756, but the production, of beet sugar exceeded that of cane by 167 543 tons.

During the last five years the production of beet sugar has been approximately double that of cane. In 1909 cane was grown on 278 233 farms



and beet on 35 682. In Louisiana two crops of cane are grown from one planting, thus the ploughing and planting of cane occurs only every other year on the same piece of ground. Planting begins in September and ends about the 1st. of March. The crop grown from this planting is called "plant cane", that produced from the preceding year's stubble is called "stubble" or "ratoon" cane and is inferior to the "plant cane".

The average yield per acre of cane increased from 10.9 tons in 1899 to 13.1 tons in 1909, and the average value per ton., \$ 4.89 in 1899, sank to \$ 4.23 in 1909, the value per acre for these two years being \$ 53.08 and \$ 55.40 respectively. \*Of the total area, 5 276 016 acres, under cultivation in Louisiana in 1909, 30.2 % was under maize, 18.1 % under cotton, and 6.2 % under cane. Of the total value of the crops, 23 % was derived from cane, 21.3 % from maize and 22.4 % from cotton. Texas produces a small amount of cane sugar, but the cane grown in the other 10 States is mostly used for syrup.

Of the 214 cane sugar factories working in 1909, all but 10 were in Louisiana; of these 22 produced syrup only. The average production of cane sugar per factory in 1909 was 1702 tons as against 8650 tons per beet sugar factory. In this year the power of the 214 cane sugar factories was 122 189 horse power, that of 68 beet sugar factories was 57 202.

In 1909 the capital invested in the cane sugar factories was \$ 38 000 000, the expenses \$ 26 000 000, and the value of the products \$ 31 000 000; these figures were \$ 130 000 000, \$ 37 000 000 and \$ 48 000 000 respectively for the beet sugar factories.

There were also, in 1909, 19 sugar refineries in the United States engaged in refining both home-grown and imported cane sugar. They were distributed as follows:

Louisiana and New York, 5 each; California, Massachusetts, New Jersey and Pennsylvania, 2 each; Texas, 1. The refineries turned out products valued at \$ 249 000 000. The production of sugar per ton of cane was 152 lbs. in 1914 and 135 lbs. in 1915.

Whereas the production of beet sugar gradually increased to 862 800 tons in 1915-16, that of cane sugar, after an average production of 350 000 tons for the 10 years 1901 to 1911, decreased rapidly to 137 500 tons in 1915-16.

The production of beet sugar was 6 times greater in 1915-16 than that of cane sugar, which it exceeded in the United States for the first time in 1906-07.

3) *Maple sugar.* — The United States and Canada are the only countries for which statistics relating to the production of maple sugar are available. The territory of the United States devoted to this industry is in the north-east, and extends from the Atlantic coast to Missouri, and from the Canadian border to North Carolina and Tennessee. The first census, taken in 1849, gave the production of maple sugar as 34 253 436 lbs. Since then the production of maple sugar has decreased by more than one half, while that of syrup has trebled. In 1899, 11 928 770 lbs. of sugar and 2 056 611 gallons of syrup were produced; in 1909 these figures were 14 060 206 lbs.

and 4 106 418 gallons respectively. Estimating the quantity of sugar in 1 gallon of syrup to be 8 lbs., there was, in 1909, a total production of 46 900 000 lbs. of sugar.

There were, in 1909, 87 537 farms making maple sugar or syrup, that is, more than 1 % of all farms in the United States. The number of trees tapped in 1909 was 18 899 533, of which 5 586 000 were in Vermont, 4 949 000 in New York, 3 170 828 in Ohio and 1 298 000 in Pennsylvania. The value of the sugar and syrup produced in 1909 was \$ 5 177 509, compared with \$ 2 636 711 in 1899, an increase of 96.4 %. The average value per farm was \$ 59 in 1909 and \$ 42 in 1899.

**IMPORTS AND EXPORTS OF SUGAR IN THE UNITED STATES.** — The imports of sugar into the United States are practically all raw. They increased from 1 000 000 tons in 1883 to 2 000 000 tons in 1902, and 3 000 000 tons in 1914. Non contiguous possessions supplied 1 000 000 tons in 1914.

The sugar exports, mostly refined, are sent to the United Kingdom, Central American States and the West Indies. In 1915 the exports amounted to 275 000, and, for the 12 months ending June 30, 1916, they were 815 076 tons.

The increased production in the United States and its possessions has caused a decrease in imports from abroad ; during the last 10 years 1903-1913, this decrease was 46 %, as compared with 79 % in the preceding decade.

850 — **Sugar and Maple Syrup in Canada.** — See No. 792 of this *Bulletin*.

851 — **Breadmaking Trials in France by the War Administration.** — BALLAND, in *Comptes Rendus de l'Académie des Sciences*, Vol. 164, No. 19, pp. 712-714. Paris, May 7, 1917.

Since early in 1915, the War Administration has been examining measures with the object of finding substitutes for wheat flour for the preparation of army bread.

Their efforts have been directed to barley, maize, rice, manioc and ground-nut flours. Chestnuts and potatoes have been disregarded as every trial since PARMENTIER has shown that these products are useless for breadmaking.

The following is a summary of the trials effected in the furnace of the Laboratory of the Invalides with the assistance of M. HENNEQUIN. The bread was made according to the rules in use in the military bakehouses.

**Barley.** — The experiments with 5-10-15-20-25-30 % of barley flour were very favourable. The flavour of the barley is only apparent where it forms more than 10 % of the bread. The crumb keeps fresh over a long period.

**Maize.** — Yellow maize flour : above 5 % the crumb acquires a yellow tinge ; at 10 % the colour is more pronounced and the specific flavour of the maize becomes evident. From 15 to 20 % the bread works well but requires more care. The crumb is closer.

**Rice.** — From 5 to 15 %, the results are satisfactory. From 15 to 20 %, working becomes more difficult ; the crumb is more compact and easily crumbles.

**Manioc.** — With 5-10-15-20 % of flour from Madagascar the work is easier than with rice. The flavour of the bread is not affected.



*Ground-nut.* — The flour prepared at Marseilles, from cakes whence the oil has been expressed, has a disagreeable leguminous flavour and was therefore slightly roasted before being used. At 5 % the flavour of the bread is hardly affected ; at 10 % a taste of rye ; up to 15 % breadmaking presents no difficulty, but above 10 % the dough is blackish and very close, like that of rye bread.

*Barley and maize ; barley and rice ; barley and ground-nut.* — The trials with a 15 % proportion of these products mixed in equal parts, gave a very acceptable product. The barley attenuates the flavour of the maize and especially that of ground-nut.

To sum up, the incorporation with wheat flour of barley, rye, maize, rice and manioc flours may, in cases of necessity, be recommended up to a proportion of 10 to 15 %. Barley flour should have the preference.

The bread making is favoured by the use of young yeasts obtained only with fine wheat flour. This is exactly what was recommended by MÈGE-MOURIÈS in order to obtain semi-white bread from grey flours.

The dough, just before it is put into the oven, contains 46 to 49 % of water ; the same proportion is found in the crumb 12 hours after the loaves have been removed from the oven. In the crust and in whole loaves the water content was the same as in the ordinary army breads.

All these breads keep for the same period of time as army bread.

The nutritive value, according to the following analyses, appears to be intermediate between those for rye and wheaten breads :

	Water	Nitrogenous matter	Fats	Starch and fibre	Ash
1* . .	12.75 %	9.10 %	1.95 %	74.95 %	1.25 %
2 . . .	12.50	8.95	4.05	73.18	1.32
3 . . .	12.86	9.45	0.20	77.07	0.42
4 . . .	12.60	1.96	0.44	84.20	0.80
5 . . .	5.40	48.56	0.62	40.02	5.40
6 . . .	29.05	9.47	0.14	59.88	1.46 (1)
7 . . .	24.68	7.06	0.20	66.24	1.82 (2)

(1) Of which 0.71 of sodium chloride

(2) Of which 0.63 of sodium chloride.

\*1) Barley flour (bolting 66 %). — 2) Yellow maize flour (bolting 90 %). — 3) Chinese rice flour (bolting 95 %). — 4) Manioc flour received from Madagascar. — 5) Ground-nut flour prepared at Marseilles. — 6) French army bread (exclusively from wheat flour). — 7) Russian army bread (with rye and caraway).

#### 852 — Deterioration of Bread caused by Yeast infected with *Oospora variabilis*. —

FICAI, G. and PEROTTI, R., in *Atti della Reale Accademia dei Lincei, Fifth series, Rendiconti, Classe di scienze fisiche, matematiche e naturali*, Vol. XXVI, Part 9, pp. 513-516, 1 Sg. Rome, May 6, 1917.

The "Laboratorio consorziale di igiene e di agraria" of the Province of Arezzo received, in 1915, a sample of bread which had deteriorated in such a way as to become quickly inedible. All the air spaces were uniformly lined with a sort of milky white veil formed by an *Oospora*, which the wri-



ters later identified as *O. variabilis* Lindner (*Monilia variabilis* Lindner). This fungus had already been observed by LINDNER on moist bread, in Berlin, but never before in Italy. By means of inoculation experiments on bread the writers have shown that, among the carbohydrates, it decomposes only glucose, setting free carbon dioxide and probably forming lactic acid. When cultivated on agar from bean broth, after 2 or 3 weeks it forms a pale pinkish-orange pigment.

The experiments on artificial production of the process of decomposition gave positive or negative results according to the conditions in which they were performed: high temperature of oven, good baking, especially when dealing with light breads, prevent the development of *O. variabilis*, whilst under-baking in an insufficiently hot oven and so leaving a high moisture content, especially with heavy breads, favour the development of the hyphomycete. The germs of this latter occur in the yeast which, in the case examined by the writers, is undoubtedly the vehicle of infection. Hence, it is necessary that yeast should be carefully kept and only properly prepared yeasts used for bread-making.

853 - **Industrial and Economic Use of Pulza-Oil, Extracted from the Seeds of the Physic-Nut Tree (*Jatropha Curcas*).**— Investigation by the COLONIAL GARDEN of France, in *Revue agricole et vétérinaire de Madagascar et Dépendances*, Year 2, No. 8, pp. 37-38. Tananarive, June 1917.

At the request of the Madagascar Government the Colonial Garden undertook an investigation into the possibilities and advantages of importing into France physic-nuts from Madagascar and adjoining districts. Sample seeds were also analysed with the following results:

Weight of 1000 seeds . . . . .	535 gr.
Composition of the seed (per cent.) {	Shell . . . . . 39.2 %
	Kernel . . . . . 60.8 %
Kernel . . . . . {	Moisture content . . . . . 7.0 %
	Oil content . . . . . 52.0 %
Oil content of the whole seed . . . . .	31.60 %

The investigation led to the following conclusions:

The physic-nut (*Jatropha Curcas*) comes, almost exclusively, from the Cape Verde and Comoro Islands.

Before the war relatively few were imported, indeed, at Marseilles in 1913 not more than 12 080 quintals arrived. This figure is rather exceptional as, generally, the annual importation into Marseilles does not appear to exceed 500 to 600 metric tons.

The yield in utilisable oil is 27 to 28 % of the total weight. The results given above show the oil content to be 31.6 % of the weight of the seed, but it should be noted that this figure represents all the oil in the seed and that, commercially, 4 to 8 % of the oil remains in the cakes, thus giving only 27 to 28 % of utilisable oil.

Pulza oil is well known and may be used for many purposes.

It is very satisfactorily used in certain soap factories, where it replaces low quality pea-nut oil.

By reason of its low acidity it should be possible to use it satisfactorily as a lubricant. It may also be used as a purified oil.

Finally, pulza oil may be used in stearine factories, but, doubtless, less generally than in soap factories; this would be chiefly dependent on the price.

Before the war, the current price of physic-nut seeds was from 13s. to 20s. per 100 kilos net.

At the present time pulza oil is no larger on the market and the current prices entirely dislocated. It is, thus, difficult to quote any value for this product. Nevertheless, it seems possible that, at the port of Marseilles, it would be possible to sell it at £ 2 per 100 kilos net.

854 - Contribution to the Study of the Oil of *Cây-doc* (*Garcinia tonkinensis*). —

HEIM, F., in *Bulletin économique de l'Indochine*, Year 20, No. 123 (new series), pp. 135-139. Hanoi-Haiphong, Jan.-April 1917.

The "*Cây-doc*" (or "*Cây-gioc*") the scientific name of which is *Garcinia tonkinensis* H. B. N., Vesque (1), is a tree of the family of the Clausiaceae, the oleagineous seed of which has long been the object of an important trade in Tonkin in view of the extraction of a burning oil.

"*Cây-doc*" oil is a mixture of true fats (mixture of glycerides of fatty acids) and of oleo-resin containing a small proportion of an ethereal oil of agreeable odour.

The oleo-resin does not appear of itself to be capable of practical use as it does not solidify either by dessication or oxidation.

"*Cây-doc*" oil, after saponification with caustic soda and decomposition of the sodium salts obtained by means of sulphuric acid, furnishes about 90 % of solid fatty acids, brown in colour, melting at 22° C. and composed of a mixture of 17 % of solid or saturated fatty acids and of 83 % of liquid or non-saturated fatty acids.

The liquid fatty acids are formed solely of oleic acid. They solidify at + 7° C. and melt at 13-14° C.

The solid fatty acids are formed of a portion corresponding to stearic acid in  $C_{18}$  and of another formed of palmitic acid in  $C_{16}$ . The melting points found are lowered (65° for the 1st. portion and 60° for the 2nd. instead, of 69° and of 62° respectively) owing to the presence of a slight amount of other acids (myristic).

The chief constants of "*Cây-doc*" oil are :

Acid number . . . . .	93.00
Koettstorfer number . . . . .	198.03
Iodine index . . . . .	67.14
Reichert index . . . . .	0.53

*Cây-doc* oil, which is easily saponifiable, is capable of giving a brown coloured soap, of similar appearance and, up to a certain point, of the same pleasant odour as palm-oil soap. Like this latter it has the faculty of absorbing a great amount of water and therefore gives an excellent yield. The

(1) See R., May 1917, No. 436.

(Ed.).

proportion of essential oil is slight (4.58 %) and hardly exceeds the insaponifiable proportion of the other oils used in perfumery; the presence of resin is in no way harmful and communicates to the soap the property of an abundant lather even in water containing selenite. Cày-doc soap, however, is coloured. This oil should undoubtedly have a place in soap-making in Europe.

*Garcinia tonkinensis* is grown in Tonkin; it matures slowly (8-10 years) and would only give a full crop of seed after 20 years. The annual crop of seed per tree should reach a Tonkin piastre (about 2 shillings).

**855 - The Manufacture of Essential Oils in the United States.** — *The Tea and Coffee Trade Journal*, Vol. XXXII, No. 6, p. 520. New York, June, 1917.

Details of manufacture of essential oils in the United States during the period from 1899 to 1914, inclusive, have been announced by the Census Bureau of the United States Government. Establishments under the classifications in the following table extract or distill the oils of various plants, such as peppermint, spearmint, wormwood and wintergreen. The quantity and value of the natural oils, and all other products of the essential oil industry, for 1914, 1909 and 1899, are given as follows:

Products	Essential Oils		
	1914 <sup>(1)</sup>	1909 <sup>(1)</sup>	1899
Number of establishments . . .	107	74	47
Total value . . . . .	\$ 2 505 361	\$ 1 773 304	\$ 813 495
Essential oil, value . . . . .	\$ 1 289 482	\$ 1 111 875	\$ 700 709
Peppermint . . . . .	lbs. 363 991	lbs. 305 781	lbs. 202 550
Value . . . . .	\$ 601 617	\$ 519 070	\$ 188 559
Spearmint . . . . .	lbs. 94 209	lbs. 33 100	(2) —
Value . . . . .	\$ 238 074	\$ 83 283	(2) —
Black Birch . . . . .	lbs. 41 178	lbs. 67 053	(2) —
Value . . . . .	\$ 67 691	\$ 102 045	(2) —
Wintergreen . . . . .	lbs. 6 000	\$ 22 281	lbs. 2 166
Value . . . . .	\$ 24 538	\$ 68 983	\$ 3 638
Wormwood . . . . .	lbs. 4 702		
Value . . . . .	\$ 9 040	\$ 338 415	\$ 508 512
Other essential oils . . . . .	\$ 348 522		
Witchhazel Extracts . . . . .	galls. 917 690	galls. 691 823	galls. 110 260
Value . . . . .	\$ 575 939	\$ 419 793	\$ 54 649
All other products . . . . .	\$ 699 941	\$ 241 706	\$ 58 137

(1) Includes two establishments in 1914 and six in 1909 which were engaged primarily in other industries.

(2) Not reported separately.

**856 - The Sanitary Control of Tomato-Canning Factories.** — HOWARD, BURTON J. and STEPHENSON, C. H., in *United States Dept. of Agriculture, Bulletin* No. 569, 29 pp., II Plates. Washington, June 25, 1917.

Following the passing of the Food and Drugs Act of June 30, 1906, the manufacture of tomato preserve from the point of view of hygiene



has made rapid progress in the United States. The following operations are now in common use : sorting the fruit (for which several machines have been invented) — working — separation of the juice from the pulp by more efficacious methods than that of the simple gravity system — conservation of the fruits to be prepared in tanks of about 20 litres capacity instead of wooden barrels.

In the present bulletin the writers deal with the following points : conditions observed in several tomato-canning factories in the United States — washing — sorting and different types of machines employed for same — utilisation of damaged fruit by removing the damaged portion and using the remainder — preparation of the pulp — cleanliness in manufacture — analytical control of the finished product.

Several factories were considered by their directors as working in good hygienic conditions, nevertheless their products contained impurities the origin of which could not be traced. Inspection of these factories showed that the methods of cleaning the machinery were defective and the sorting of the fruit not uniform.

The method of cleaning the tomatoes should be in relation to the nature of the soil which has grown them ; if this latter is sandy and friable it is sufficient to wash them by spraying, that is to say by exposing them to jets of water over the different parts of their surface ; if the soil is compact, brushing under water is indispensable.

Generally speaking the fruit is not sorted sufficiently carefully by putting on one side all damaged tomatoes ; this latter is probably the most important point in the manufacture of good, healthy preserve.

The sorting should be done by skilled, responsible workmen, and they should work in relays changed every 3 hours. If a belt conveyor is used passing in front of the sorters, its speed should be regulated according to their skill and should be uniformly fed. According to the writers the best width for the belt is 45 to 50 cms. The sorting room should receive light from above and be lighted artificially on dull days.

The choice of damaged fruit and the retention of the sound portions should be two separate operations, carried out by different batches of workers.

It is extremely difficult to prepare a preserve which complies with all the rules of hygiene by using only sound portions of damaged tomatoes, besides, it is doubtful whether such manufacture is profitable even when properly carried out. It is much better to eliminate completely the spoiled portions and to prepare preserves by means of the sound portions mixed with tomatoes previously put aside as being too small. The proportion of damaged portions should be, at the maximum, 1 % in the material to be worked. Rapid preparation is essential in order to prevent spoiling.

It is impossible to be too careful about cleanliness. The best results are obtained by organising the cleaning of the machines systematically, piece by piece ; every worker should have his share of the responsibility.

The analytical control of the finished products has proved to be of great advantage.

857 - "Grape Honey". — MARTINOTTI, F. (R. Stazione enologica, Asti), in *Giornale vinicolo*, Year 43, No. 31, p. 362. Casale Monferrato, August 5, 1917.

The author describes a method, discovered by MONTI (1) for the preparation of a new product called "grape honey".

The grape must is subjected to two successive treatments; 1) freezing; 2) concentration. The freezing removes the excess of acid, the impurities and about  $\frac{1}{4}$  of the water. Concentration, under greatly reduced pressure and at low temperature, removes the desired quantity of water either for the preparation of the syrup, or for that of the "honey", a crystallised product with the appearance of honey and the food and therapeutic value of grape juice.

By the MONTI method the must obtained from pressing the grapes and the liquid obtained from the skins are used. By mixing these two liquids either before or after the freezing, a product is obtained, which MONTI calls "integral", because it contains all the products of grape juice.

858 - A Bacteriological Study of the Natural Coagulation of the Latex of *Hevea brasiliensis*. — DENIER and VERNET, in *Comptes rendus des Séances de l'Académie des Sciences*, Vol. 165, 2nd. Half Year, No. 3, pp. 123-126. Paris, July 16, 1917.

When collected under perfectly clean conditions *Hevea* latex is as white as milk. Left in the vat, it usually turns yellowish-white on the surface, sometimes even black or green, and coagulates, like milk, in about 48 hours. The bacteria, few to begin with, multiply rapidly, and the presence of a large number of species of bacteria may be noticed.

This natural coagulation is no longer practised on account of the lack of uniformity in the results obtained with it, and the smell of putrefaction it gives off; nevertheless the value of the rubber obtained is realised.

GRANTHAM and EATON have already shown the action of bacteria on the sugars and albuminoids of latex, which can, in part, disappear. In their experiments the authors isolated 27 species of aerobes or facultative aerobes and one anaerobic microorganism. The bacterial flora appeared to be very variable; only one bacillus was always isolated in every case. This was a short bacillus with rounded ends, very slightly motile and Gram negative; it turns latex serum litmus gelatine first red, then colourless, and turns litmus milk red and then coagulates it; inoculated into latex in basins it coagulates it in 24 hours.

For several months this bacterium has been used for coagulating latex at Nhssa-Trang (Annam), but in order to obtain good results certain precautions must be taken.

1) If coagulation is slow it is well to add some sugar to hasten it (as a rule 1 gr. of sugar per litre of latex is sufficient).

2) On the surface of the coagulated latex there is an alkaline scum in which are large, very aerobic bacilli which inhibit coagulation at this level. Sugar prevents their growth, but better results are obtained if the conditions are completely anaerobic. For this purpose it suffices to float a piece of wood on the surface of the liquid as this prevents the growth of

(1) See also B. 1914, No. 946.

(Ed.)



aerobic bacteria. The rubber thus obtained is white at first, but later becomes less so; to avoid this change it is sufficient to sterilise it by heat or to treat it with formol solution. Similar results may be obtained by keeping it from contact with air for at least 4 days.

3) Zinc vats cannot be used for coagulation on account of the toxic action of the zinc salts on the microorganisms of the latex.

INDUSTRIES  
DEPENDING  
ON ANIMAL  
PRODUCTS

859 - **The Sterilisation of Liquids in Thin Streams by Heat.** — STASSANO, HENRI, in *Comptes Rendus des Séances de l'Académie des Sciences*, Vol. 165, No. 1, pp. 41-43. Paris, July 2, 1917.

In this method, on which a short note was previously presented to the Académie des Sciences (Vol. 160, Year 1915, pp. 820-822), the liquid passes, under uniform pressure of a compressed, inert gas - nitrogen - through a heating apparatus formed by two superposed rectangular metal sheets; these are held apart by a paper frame 0.1 mm. thick, which limits the perimeter of the receiver.

Long experience with this method has shown that it gives the following advantages over the usual sterilisation methods:

1) The liquid may be raised as quickly and as regularly as possible to the desired temperature;

2) The liquid may be cooled as soon as it has reached the requisite temperature by passing it immediately from the heating apparatus to a cooling apparatus under the same stream of nitrogen. The detrimental effect of heat is thus stopped as soon as its purpose is fulfilled. Neither this last advantage of rapid cooling nor that of raising the temperature almost instantaneously, can be obtained in a closed vessel;

3) A large volume of liquid may be dealt with. Sterilisation in a closed vessel is always limited by the size of the water-bath or the autoclave. In the small apparatus (27 cm.  $\times$  17 cm.) used by the author, more than 100 litres of physiological solution and 30 to 40 litres of bacterial emulsion may easily be sterilised in one hour without exceeding a pressure of 2 kg. or unduly raising the temperature.

By comparing the results obtained by this method with those obtained by sterilisation in closed vessels, it is very clearly seen that the duration of heating is the principal factor in the changes caused by heat in living beings and their albuminoid organic substances. The degree of heat, within certain limits of course, plays only a secondary part.

After giving several examples of the sterilisation of cultures, the author states that cow's milk, sterilised at 126° to 128° C by this method, has neither the colour nor characteristic boiled taste of milk sterilised in bottles in the autoclave at a temperature below 115°. A still more remarkable fact is that milk, sterilised in thin streams, even when raised to a temperature of 135°, is much less affected by heat where the action of rennet is concerned than milk which has been boiled for a few minutes. Indeed, this milk, whose colour and natural taste show no trace of the test to which it has been put, coagulates with rennet almost as rapidly as fresh milk, and forms a thick coagulum, from which exudes very slightly a perfectly transparent serum, as is the case with fresh milk. The same milk, heated to 100° over the wa-



ter-bath, gives a slower and less compact coagulum, showing streaks resembling precipitates; the abundant serum is greenish. It is well known that milk sterilised in the autoclave is no longer coagulated by rennet.

The results obtained from the author's many experiments on heating in thin streams are further confirmed by the following fact:

Milk heated to 75° C for 5 minutes over the water-bath, that is to say, before the whole mass has reached this temperature, no longer gives the oxidising and reducing diastase reaction. The same milk heated in the author's apparatus, even to a temperature of 80°, still reacts very distinctly to the reagents showing the presence of these enzymes. Only in the case of peroxidase is the reaction somewhat weaker.

860 - **Paying for Milk in Cheesemaking.** — TROY, H. C. (New York State College of Agriculture), in *Hoard's Dairyman*, Vol. LIII, No. 15, pp. 647-649. Fort Atkinson, Wisc., May 4, 1917.

The methods of paying for milk which the larger milk purchasing companies of the United States have put into practice are due to the ordinary variations that occur in the composition of the milk from different herds and the effects of these variations on its economic value.

The percentages of fat and solids not fat found by the chemical analyses, during the past fifteen years, in the milk of 1228 herds, made up of the various breeds and types of cows found in western New-York, are as follows:

TABLE I.

Number of herds	Percentage of fat	Average Percentage of Solids not Fat
241	3.5 and under	8.243
376	3.51 to 4.0	8.572
331	4.01 to 4.5	8.677
178	4.51 to 5.0	8.858
102	5.01 and over	9.077

1228

This shows that there is an increase in the average percentage of solids not fat for any large number of samples as the percentage of fat increases. The increase, however, for the solids not fat is not at an exactly even rate, nor is it so great as the increase for the fat.

Allowing due consideration for the variations in ratio that will be found in single samples, the assumption is made that, as the percentage of fat increases, there would be an increase in the solids not fat and in the food value similar to that shown in the following table II.

TABLE II. — *Comparative Value of a Quart of Milk of Different Compositions*

Fat	% Solids Not Fat	Energy Units	Cents per quart (1)
3.0	8.3	604.10	4.0
3.5	8.5	665.46	4.4
4.0	8.7	726.82	4.8
4.5	8.9	788.18	5.2
5.0	9.1	849.54	5.6
5.5	9.3	910.90	6.0
6.0	9.5	972.26	6.4

(1) Value is based on a price of 4 per cents per quart for milk with 3 % fat.

*Relation of Composition to Cheese Yield.* — The Babcock test affords a practical means by which the factory may determine the percentage of fat in milk, but the tests for casein are more difficult to make and, while some of them work fairly well, none have come into general use.

The percentage of casein, like the percentage of solids not fat in either rich or poor milk, may vary within quite wide limits, but the amount present in rich milk will average somewhat higher. While the richer milk contains a larger quantity of casein per hundredweight, the amount present in proportion to each pound of fat is greater in the milk having the low fat content.

As a basis for work in determining a fair method of paying for milk that is to be made into cheese, a standard may be adopted with which suggested methods may be compared. For the present it may be assumed that any method is fair that will give the same returns to each producer that he would secure were his milk made into cheese separately. VAN SLYKE has shown that when 100 lbs. weight of pure milk is made into cheese the yields may vary according to the percentage of fat as shown in Table III.

TABLE III. — *Yield of Cheese From Milk of Different Tests.*

Fat %	lbs. of cheese per 100 lbs. milk		cents per lb.	Returns for 100 lbs. milk	Difference in cents per 100 lbs. of milk	Gain or Loss over Flat Rate of \$ 2.12 per 100 lbs. for all milk
3.0	8.30	×	20	\$ 1.66	0.00	\$ — .46
3.5	9.45	×	20	1.89	0.23	— .23
4.0	10.60	×	20	2.12	0.46	.00
4.5	11.75	×	20	2.34	0.68	+ .23
5.0	12.90	×	20	2.58	0.92	+ .46

*Returns by the Fat Percentage Basis.* — If the five 100-pound lots of milk of table III were made into cheese, 53 lbs. would be produced, bringing \$ 10.60 when sold at 20 cents a pound. The milk contained 20 pounds fat and, if the money were distributed on the fat percentage basis, each pound of fat would be credited with 53 cents. The difference between the returns by the Fat Basis and the returns when such milk is made up separately is shown in table IV.

TABLE IV. — *A Comparison of the Returns by the Fat Percentage Basis with the Returns when such Milk is made into Cheese Separately.*

Fat %				Returns by Fat Basis	Returns when Made up separately	Difference
3.0	×	53	=	\$ 1.590	\$ 1.66	\$ — .070
3.5	×	53	=	1.855	1.89	— .035
4.0	×	53	=	2.120	2.12	.000
4.5	×	53	=	2.385	2.34	+ .035
5.0	×	53	=	2.650	2.58	+ .070

On the fat percentage basis the richer milk receives a larger share of the proceeds than it would were it made up alone, and the poorer milk

receives a proportionally less amount. But the error is small compared with that which occurs when the money is distributed according to the number of pounds of milk delivered.

The price of twenty cents a pound for all the cheese is another point to be considered. The energy unit values is a pound of cheese from each of five different samples of milk containing different percentages of fat are shown in Table V.

TABLE V. — *Energy Value of Cheese Made from Milk of different Tests (1).*

Fat %	Energy Units per lb. of cheese	Difference in Energy Units per lb of cheese	Lbs. of Cheese per 100 lbs. milk	Extra Energy Units due to composition of cheese	Value of Extra Energy Units cents
3.0	1870	—	8.3	—	—
3.5	1890	20	9.45	189.0	2.02
4.5	1918	48	11.75	563.5	6.02
5.0	1932	63	12.90	812.7	8.69

(1) In calculating these values each cheese is given the same percentage of moisture.

The richer milk produces cheese containing a higher fat content and lower casein content than is found in cheese from poor milk.

The extra fat not only makes up for the lower percentage of casein but also supplies the extra energy units contained in cheese from the richer milk. If allowance is made for this difference in food value and a price of twenty cents a pound is placed on the cheese from the milk containing 4 % fat, the values shown in table VI are obtained.

TABLE VI. — *Value of Cheese when Energy Values are Added.*

Fat %	Pounds Cheese	Cents per pound	Value of Cheese per 100 lbs. milk	Value on Fat Percentage Basis	Difference
3.0	8.30	19.644	\$ 1.630	\$ 1.590	— \$ 0.040
3.5	9.45	19.786	1.869	1.855	— 0.014
4.0	10.60	20.000	2.120	2.120	0.000
4.5	11.75	20.156	2.366	2.385	+ 0.019
5.0	12.90	20.317	2.620	2.650	+ 0.030

The last column in table VI shows the difference in values by the fat percentage basis compared with a method which gives credit to the yield and food values of the cheese from each grade of milk. The milk containing the lower percentages of fat would receive a few cents less per hundred than an absolutely correct method would give, while the richer grades of milk would receive a few cents more than is due.

In the fat percentage basis method the extra fat of the richer milk moreover assists in producing the better flavour, aroma, texture and pala-



tability of the cheese having a high fat content and may more than make up for any apparent discrimination against milk of lower fat content, when, in cheesemaking, milk is bought on the fat percentage basis.

- 861 - **The Use of Selected Ferments in Cheese-making.** — GORINI, C., in *Rendiconti del Reale Istituto Lombardo di Scienze e Lettere*, Series II, Vol. I., Pt. 7-8, pp. 302-310. Milan 1917.

The author examines the results obtained during the last 10 years by the use of selected ferments in cheese-making. He concludes that the quality of these ferments is subordinate to good hygienic and bacteriological preparation. His remarks may be summarised as follows :

During the 10 years which have passed since it was first proposed, at the Milan International Exhibition of 1906, to use selected ferments in cheese-making this method has made great progress. Its success is due to the support and help received from the "Pro Grana" Society, under the Italian Ministry of Agriculture, and from many institutions.

Ten years' experience shows that the new method is of great economical and hygienic service to the cheese industry because it improves the produce, gives a greater guarantee of success and shortens the period of ripening. The chief obstacle lies in the ignorance of the cheese-makers on the subject of ferments ; they neither know how to prepare yeasts, nor how to regulate the work so as to favour the growth and action of the ferments that coagulate casein at the expense of those that prevent coagulation.

The help of the qualified teachers filling the travelling chairs in Agriculture has been of great value, as they have all followed bacteriological courses in the agricultural colleges. But this is not enough. The collaboration of cheese-making specialists with a good knowledge of hygiene and bacteriology is absolutely essential. Such specialists are still too rare, and it is of great importance to the dairy industry that more should be trained.

- 862 - **The Desiccation of Meat Resulting from Freezing and Cold Storage.** — FREIMAN, K., in *Холодильное дело (Cold Storage Industry)*, pp. 339-357. Moscow, November-December, 1916 ; summary in *Bulletin Mensuel de l'Association Internationale du Froid*, *Bulletin Bibliographique*, Year 8, Vol. 8, No. 1, pp. 8-10. Paris, January-March, 1917.

The desiccation of meat during cold storage is dependent on the method of preserving : 1) chilling ; 2) freezing between  $-2^{\circ}$  and  $+2^{\circ}$  C. ; 3) freezing at the same temperature and drying the meat till a light surface crust is formed ; 4) freezing with strong desiccation.

The author studied the question of the desiccation of meat from data furnished by the Moscow Kazan Railway cold-storage dépôt, and gives the results in a series of tables. He shows that the desiccation of frozen pork is much less marked than that of beef, especially during the first days. This is shown by Table I, which summarises the data collected.

Certain data on the desiccation of meat were obtained from various dépôts which, though not sufficiently constant to warrant precise deductions, are nevertheless of interest ; they are summarised in Table II.

TABLE I. — *The desiccation of different kinds of meat.*

Meat	Length of time kept	Daily desicca- tion %	Monthly desicca- tion %	Monthly desicca- tion average %	Observations
Beef :					
Freshly killed . . . . .	19 days	0.121	3.63	1.86	The average desiccation of frozen, chilled and thawed meat is 0.93 % per month.
» » . . . . .	up to 2 months	0.057	1.71		
» » . . . . .	» 3 »	0.055	1.65		
» » . . . . .	» 4 »	0.038	1.14		
Refrigerated ' . . . . .	» 1 »	0.036	1.08	1.08	
Chilled, packed in matting.	» 1 »	0.047	1.41	0.63	
» » » . . . . .	from 1 to 2 »	0.018	0.54	0.63	
» » » . . . . .	» 2 to 3 »	0.022	0.66	0.63	
» » » . . . . .	» 3 to 4 »	0.011	0.33	0.63	
Chilled, unpacked . . . . .	up to 1 »	0.030	0.90	0.90	
Thawed in matting. . . . .	» » 1 »	0.031	0.93	0.93	
» » » . . . . .	from 1 to 2 »	0.036	1.08	0.93	
» » » . . . . .	» 2 to 3 »	0.031	0.93	0.93	
» » » . . . . .	» 3 to 4 »	0.021	0.63	0.93	
Thawed, unpacked . . . . .	up to 1 »	0.037	1.11	1.11	
Pork :					
Freshly killed . . . . .	15 days	0.358	—	6.30	165 fount (1)
» » . . . . .	22 »	0.185	—	6.30	92 »
» » . . . . .	26 »	0.087	2.61	6.30	139 »
Chilled. . . . .	130 »	0.010	0.30	0.30	235 »
Chilled cutlets . . . . .	189 »	0.019	0.57	0.57	14 »
Fresh ham. . . . .	35 »	0.093	2.79	1.83	26 »
» » . . . . .	73 »	0.029	0.87	1.83	32 »
Smoked » . . . . .	225 »	0.015	0.45	0.45	27 »
Mutton :					
Freshly killed . . . . .	40 »	0.167	5.01	5.01	90 »
Goat's meat :					
Freshly killed . . . . .	44 »	0.091	2.73	2.73	50 »

(1) 1 fount (Russian pound) = 0.40951 kg.

Taking the above-mentioned figures as a basis it may be said that the desiccation of freshly killed meat during chilling and preserving should not exceed (with a temperature of from 10 to 15° C.) : —

For 20 days. . . . .	2.50 %	For 45 to 60 days . . . . .	1.75 %
For 20 to 30 days . . . . .	2.55 %	For 60 to 90 days . . . . .	1.50 %
For 30 to 40 days . . . . .	2.00 %	For 90 to 120 days . . . . .	1.00 %

TABLE II. — *Desiccation of meat in various cold-storage depôts.*

Method of preserving	State of meat when brought to the dépôt	Length of time kept	Cold-storage dépôt				STETEFELD'S results	TELLIER'S experiments
			Moscow-Kazan railway	Union Society	Smolensk	Thorn		
Chilling and preservation	Meat freshly killed		General desiccation, percentage.					
		10 days	—	1.61	—	—	—	—
		19 "	2.30	2.03	—	—	—	—
		from 20 to 30 days	—	2.07	—	—	—	—
		from 30 to 40 "	—	1.26	—	—	—	—
			Monthly desiccation, percentage.					
		from 1 to 2 months	1.71	—	—	—	—	—
		from 2 to 3 "	1.65	—	1.00	—	—	—
		from 3 to 4 "	1.14	—	—	2.20	—	—
		up to 9 "	—	—	—	1.98	—	—
Refrigeration and desiccation	"		General desiccation, percentage.					
		up to 1 month	—	—	—	—	—	10
		up to 2 "	—	—	—	—	—	15
Chilling and preservation	pork		General desiccation, percentage.					
		up to 10 days	—	—	—	—	1.87	—
		" 15 "	5.37	—	—	—	—	—
		" 20 "	—	—	—	—	2.60	—
		" 22 "	4.07	—	—	—	—	—

The great difference in the figures for the desiccation of pork given by the Moscow-Kazan railway and by STETEFELD is explained by the fact that, in the first case, the desiccation of the carcass during refrigeration (3.5 %) has been taken into consideration. If this factor is deducted the figures are almost equal: 1.87 %. The same applies to the second figure, 4.07.

AGRICULTURAL  
PRODUCTS;  
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ETC.

863 — **The Refrigeration of Fruit.** — SMITH, EDWIN and CREELMANN, J. M., in *Department of Agriculture, Dairy and Cold Storage Series, Bulletin No. 51*, pp. 2-16, 8 plates. Ottawa, February, 1917.

The experiments described in this bulletin were undertaken to determine the degree of refrigeration required by different varieties of packed fruit when cooled to a given temperature. The method adopted to cool fruit rapidly in 4 or 5 hours to a temperature below freezing point was also compared with that by which fruit is cooled slowly during 18 to 24 hours.

The packed fruit was divided into 4 lots, two of which were kept at 4.4° C, that is to say, at the temperature of a refrigerating van, and the other two at 0° C. One of the two lots of each temperature was cooled rapidly at



a temperature below  $-3.8^{\circ}\text{C}$ , whereas the other was gradually cooled at  $4.4^{\circ}\text{C}$ . for several hours. During rapid refrigeration, the fruit was removed as soon as the internal temperature of the packet had reached from  $0^{\circ}\text{C}$  to  $4.4^{\circ}\text{C}$ ., so as to avoid freezing.

The author summarises the results of these experiments as follows :

Soft fruits, such as raspberries, cherries, plums and peaches may be cooled for a very short time at a temperature as low as  $-9.4^{\circ}\text{C}$ . without any bad effects so long as they are taken out before they reach freezing point.

With strawberries, cucumbers and melons, very low temperatures must be used with great care, though there is no danger in using temperatures below  $0^{\circ}\text{C}$  if cooling is stopped when the fruit has reached  $3.3^{\circ}\text{C}$ .

With the exception of the above mentioned fruits, there is no danger of damage from low temperatures in any case, so long as momentary freezing does not take place. Freezing only occurs when the fruit has been kept at  $0^{\circ}\text{C}$  for some time. Even if the fruit is cooled at a temperature of  $-9.4^{\circ}\text{C}$ . it reaches this temperature only after several hours.

By using a temperature of  $-9.4^{\circ}\text{C}$ . most of the baskets of fruit are cooled from  $23.8^{\circ}\text{C}$ . to  $4.4^{\circ}\text{C}$ . in 4 hours. If a temperature of  $0^{\circ}\text{C}$  is used most of the baskets of fruit will cool from  $23.8^{\circ}\text{C}$ . to  $4.4^{\circ}\text{C}$ . in 10 hours, and at a temperature of  $3.3^{\circ}\text{C}$ . most of them will cool from  $23.8^{\circ}\text{C}$ . to  $4.4^{\circ}\text{C}$ . in 18 hours.

Refrigerating establishments should be constructed to carry out rapid refrigeration. A model establishment should be able to cool fruit from  $29.4^{\circ}\text{C}$ . to  $4.4^{\circ}\text{C}$ . in less than 10 hours. Fruit received one afternoon should be sent out on the following midday so that warm fruit can be received in the afternoon, and supplementary labour could be employed to deal with it.

Rapid refrigeration shortens the time of delivery, not only by the number of saved hours from slow refrigeration, but often, in the case of long distance trains running only once a day, by 24 hours.

864 - **The Trend of the Wine Industry; Comparison with the Coffee Industry.** — GOUV, P., in *Revue de Viticulture*, Year 24, Vol. XLVI, No. 1180, pp. 87-89. Paris, 1917.

The aim of this article is to show that the wine industry may be greatly developed all over the world and to point out the conditions of this development. If this industry has not progressed it is for purely economic reasons, and, by modifying these causes, progress, which is at present at a standstill, may be continued.

This industry is compared to that of coffee, which has developed enormously, and it is shown that the wine trade might make just as great strides as the coffee trade if only the countries interested act with foresight.

Coffee is today grown over an area of 9 884 400 acres, and the annual production varies from 1 000 000 to 1 200 000 tons, representing a value of more than 40 million sterling. The annual production of wine from an area of 15 million to 17 million acres is from 3080 million to 3300 million gallons, representing a value of from 120 to 140 million sterling.

There is, moreover, an analogy between wine and coffee from the point of view of production. More than  $\frac{5}{6}$ ths. of the wine produced is grown

in south-western Europe (France, Italy and Spain), and about  $\frac{7}{8}$  ths. of the coffee is grown in Brazil.

On the other hand, where international trade is concerned, wine and coffee present an extraordinary contrast: at least 95 % of the wine is consumed by the countries which produce it and barely 5 % is exported, whereas only 10 % of the coffee is consumed on the spot and 90 % is exported.

As regards monetary value, the international wine trade, although concerned chiefly with choice wines worth, on an average 3 to 10 times more than ordinary wines, only reaches a total not exceeding from £ 14 000 to £ 16 000 as compared with the total of 120 million pounds represented by the annual harvest, that is to say about  $\frac{1}{10}$  th. The international trade in coffee is three times as great: — 40 million pounds as compared with 43 million pounds the value of the harvest, or about  $\frac{9}{10}$  ths.

The consumption of coffee varies greatly in the different importing countries;  $4\frac{1}{2}$  to  $5\frac{1}{2}$  lbs. per head in France, more than  $6\frac{1}{2}$  lbs. in Switzerland,  $8\frac{3}{4}$  lbs. in Belgium and the United States, and 11 lbs. in Holland. The monetary value of this consumption is much greater than that of wine. — 6s. to 8s. per person in North America, Belgium and Holland, whereas, for wine, the consumption equals 1s. 6d. per head in Belgium, 6d. in Holland, 1d. to  $1\frac{1}{2}$  d. in the United States.

The chief cause of the great difference between the international trade in wine and that in coffee is due solely to the *high price* of wine and the relatively *low price* of coffee in those countries which produce neither the one nor the other. This is emphasised by the fact that in these countries, the moneyed classes drink much more wine than coffee.

If wine is *too dear* for the masses, and even for well-to-do people, it is simply on account of the duty, which, for ordinary wines, raises the price demanded from the consumer by 200 to 300 %, or even more. Without these exorbitant duties a litre of common wine would not cost more than a litre of sugared coffee and people with moderate incomes would not hesitate to buy it. Moreover, in countries, such as France and Spain, where the duty on coffee is high, the consumption of coffee is much lower than in other countries.

In the Latin countries of Europe the export wine market has not been understood, and the home market only has claimed attention. The export of wine throughout the world could be developed considerably and form a great source of wealth to all these countries. To this end these European countries should imitate the coffee-producing countries, which consider the exportation of this product as one of the essential bases of their international negotiations. They should, by international treaties, demand the general and serious revision of the customs duties, and, either that they should be completely suppressed or, at least, considerably lowered; in one word, they must seek the *enfranchisement* of wine.

## PLANT DISEASES

### GENERAL INFORMATION.

865 - Decree of the Italian Minister of Agriculture Suspending the Importation of Certain Plants or Portions of Plants into the Kingdom. — *Gazzetta ufficiale del Regno d'Italia*, Year 1917, No. 203, pp. 3749-3750. Rome, August 28, 1917.

Owing to the importance during war-time, of not interfering with the importation of food stuffs or with any of the raw material intended for industrial purposes, and in view of the necessity of preventing the introduction, along with certain products, of parasites or pests dangerous to crops within the realm, the Italian Minister of Agriculture has issued, under date of July 12, 1917, the following decree which entered into force on August 29:

Sole article. — Article 9 of the ministerial decree of April 25, 1917 (1), is modified as follows:

The importation of the following plants or portions of same is suspended:

a) cuttings and rooted cuttings of European and American vines from France, Spain, United States of America and Canada; the existing anti-phylloxera regulations remaining in force;

b) live chestnut seedlings from the United States of America.

Fresh fruit of any kind whatever from the following countries: Canada, U. S. A., Chili, Hawaii, Japan, China, Australia, are allowed to be imported under the condition of their being inspected by the delegate for Phytopathology who must declare the total absence of parasites.

The same regulation applies to citrus fruits and to potato tubers of whatever origin.

866 - Decree Amending the Single Text of the Laws Controlling the Spread of Phylloxera in Italy. — *Gazzetta ufficiale del Regno d'Italia*, Year 1917, No. 180, p. 3441. Rome, July 31, 1917.

The Italian Regent, under date of May 31, 1917, has issued the following decree No. 1144 modifying article 9 of the law of June 26, 1913,

LEGISLATIVE  
AND  
ADMINISTRATIVE  
MEASURES  
FOR THE  
PROTECTION  
OF CROPS

(1) See R. July 1917, No. 679.

(Ed.)



No. 786 (1), amending the single text of the laws against the spread of phyloxera:

Sole article. — Art. 9 of the law of June 26, 1913, No. 786, is amended as follows.

“ The Government has the faculty of grouping and publishing in single text, after consultation with the State Council, the measures contained in the laws of June 6, 1901, No. 355 ; of July 7, 1907, No. 490 ; of May 24, 1874, No. 1934 ; of May 30, 1875, No. 2517 ; of March 29, 1877, No. 3767 , of April 3, 1879, No. 4810 ; of July 14, 1881, No. 301 ; of April 29, 1883, No. 1295 and of February 12, 1888, No. 5202 (3rd. series) with the measures contained in the law of June 26, 1913, No. 786, and also of regulating, on the basis of the laws already existing, the condition of the delegates of the antiphyloxera department and of the technical assistants, while fixing at the same time the contributions which the antiphyloxera Consortiums will have the faculty of adding to their incomes.

The application of the single text forming the object of the present article will be provided for by an order *ad hoc* which is to be approved by royal decree upon the proposition of the Minister of Agriculture.

The present decree will be placed before Parliament in order to receive the force of law ”.

## DISEASES DUE TO FUNGI, BACTERIA AND OTHER LOWER PLANTS.

### GENERAL

867 — **Fungi of Switzerland.** — JAAP, OTTO, in *Annales Mycologici*, Vol. XV, No. 1-2, pp. 97-124. Berlin, 1917.

Enumeration of about 450 species of fungi, properly so called, and of 16 species of myxomycetes, observed by the writer during a journey in Switzerland in the summer of 1910 and in mid-April 1913, near Lugano.

Among the species recorded, many are new for Switzerland, 13 are to be considered as new to science and, finally, a great number live upon cultivated or useful plants.

868 — **Fungi of Tonkin.** — PATOUILLARD, M., in *Bulletin trimestriel de la Société Mycologique de France*, Vol. XXXIII, Parts 1-2, pp. 50-63. Paris, 1917.

Among the species enumerated occur the following :

1) *Septobasidium albidum* Pat., observed on scale-insects living parasitically on leaves and branches of *Citrus* grown in the neighbourhood of Hanoï ;

2) *Sept. bogoriense* Pat., on scale insects living on stems of cultivated roses at Daïdong ;

3) *Corticium salmonicolor* B. and Br., on branches of coffee, Cho Ganh ;

4) *Hymenochaete noxia* Berk., on roots of coffee in the same locality ;

5) *Trogia Caryotae* n. sp., on rootlets of *Caryota urens* at La Pho ;

6) *Pleurotus radicosus* n. sp., at the foot of the "Jak-plant" (*Artocarpus integrifolia*), apparently attached to the roots, in the same locality.

7) *Sclerotinia Libertiana* Fckl., at Cho Ganh; the sclerotium upon the branches of *Hibiscus Rosa-sinensis* which it destroys; the organs attacked are marked upon their surface by characteristic white blotches; a black sclerotium first forms beneath the bark, becoming apparent later on upon the outside;

8) *Myriangium Duriaci* Mtg. and Bk., on scale-insects with *Septobasidium bogoriense*, on the bark of *Aleurites triloba* at Cho Ganh;

9) *Meliola manca* Ell. and Mart. on the upper surface of leaves of a *Rubus*, in the same locality;

10) *Munkiella melastomata* v. Höhn., on the upper surface of leaves of a *Melastomaceae*, also at Cho Ganh.

869 - Further Researches on the Morphological Variations Due to Environment in *Coniothyrium tirolense* and *Phyllosticta pirina* (1). — MUTTO, ELISA and POLLACCI, GINO, in *Rendiconti delle sedute della Reale Accademia dei Lincei, Classe di Scienze fisiche, matematiche e naturali*, 1st. Half-Year 1917, Vol. XXVI, Part 9, pp. 498-502. Rome, 1917.

The writers' latest researches on the variations determined by the influence of the medium on certain micromycetes show that the various culture media employed (potato, carrot, beet, glucose agar, beer must) influence the dimensions and shades of colour of the conidia of *Coniothyrium tirolense* Bubak.

With a given nutrient medium (gelatinised beer-must), the spheriopsisid, at present classified as *Phyllosticta pirina* Sacc., has produced feebly coloured septate conidia, that is to say, it has become converted into a form having the characters of the genus *Ascochyta*. In cultures on lemon juice neutralised with caustic soda and with the addition of gelatine, several hyaline, septate conidia were obtained.

The conidias retained their septa and slight colouration in new generations obtained in the same medium.

All other factors remaining the same, the nutritive medium only varying, the acquired character disappeared, that is to say, in succeeding generations, the fungus again began to produce non-septate conidia.

During the life of the culture, but never before the formation of the conidia, *Phyll. pirina* gave special formations, club-shaped and divided by septae both longitudinally and transversely ("appressoria" of C. H. CRABILL), which the writers call "macrosporioidi" from their close resemblance to the conidia of the genus *Macrosporium*.

W. B. MERCER, who has observed similar formations in *Phoma Richardiae* MERCER, attributes them, on the contrary, to the genus *Alternaria* and not to *Macrosporium*.

The formations studied by the writers are generally isolated and it is for this reason they have thought good to call them "macrosporioidi"; when occasionally, they unite in chains, they also result in a club-shaped formation.

(1) See on this subject B. Oct. 1915, No. 1092.



RESISTANT  
PLANTS

870 - **Disease Resistant Market-Garden Plants in Maryland, U. S. A.** — See this *Review*, No. 824.

MEANS  
OF PREVENTION  
AND CONTROL

871 - **Patents for the Control of Diseases and Pests of Plants.** — See *Review* for August, 1917, No. 758, and this present *Review*, No. 844.

DISEASES  
OF VARIOUS  
CROPS

872 - **Grain Mildew (*Sclerospora macrospora*) in the Government of Podolia, Russia (1).** — GARBOWSKI, L., in *Bulletin trimestriel de la Société Mycologique de France*, Vol. XXXIII, Parts 1-2, p. 33. Paris, 1917.

The presence of *Sclerospora macrospora* Sacc. has been observed in a corn-field situated near the town of Felszyn, in the western part of the Government of Podolia.

The field was examined in spring (May 15, 1915): the plants attacked did not exceed 10-15 cms. in height.

The parasite had already formed well-developed oospores, situated in the tissues of the lower leaves, especially towards the apices. The affected portions gradually turned yellow. Numerous brown patches of the size of a pin's head, distributed irregularly over the sick portions, contained oospores either solitary or united in groups. The dimensions of the oospores seemed to depend upon the amount of space which they could find for development: thus, the solitary oospores are usually larger (from  $94 \times 85 \mu$  to  $60 \times 53 \mu$ ) than those occurring in groups (from  $56 \times 46 \mu$  to  $25 \times 25 \mu$ ). Neither the mycelium nor conidiophores of the parasite could be found in the leaves of dead plants.

873 - ***Spondylocadium atrovirens*, a Hyphomycete Parasitic on Potato Tubers, New to Italy (2).** — PEYRONEL, BENIAMINO, in *Rendiconti delle sedute della Reale Accademia dei Lincei, Classe di Scienze fisiche, matematiche e naturali*, 1st. Half-Year 1917, Vol. XXVI, Part 9, pp. 509-512. Rome, 1917.

The fungus *Spondylocadium atrovirens* Harz is recorded as new to Italy. It was noticed by the writer in November 1916 and during the following winter on potato tubers from the Roman market and, again in April 1917, on numerous tubers of the same plant, at Riclaretto, in the Waldensian valleys of Piedmont.

This fungus, first recorded occurring on potato tubers at Vienna, has been found hitherto not only in Austria, but also in Germany, Denmark, Ireland, Scotland, United States and Australia.

The writer, after describing the principal characters of the fungus, adds that he has observed that the mycelium invades the corky cells of the periderm of the tuber but has never been able to find it in the underlying starch layers.

The pathogenic importance of this hyphomycete seems to be very limited and probably it is only in exceptional cases that it presents any serious danger. However, it would be worth while to eliminate the affected tubers, and, if the disease threatens to become serious, to avoid, for several years, growing potatoes in fields from which contaminated tubers have been taken as the soil may be infected with the sclerotia of the parasite.

(1) See also *R.*, Oct. 1916, No. 1128. — (2) See also *R.*, Sept. 1916, No. 1034.

— (Ed.)



**874 - *Bacterium Phaseoli*, Injurious to Field Beans in Michigan, United States.**

— MUNCIE, J. H., in *Science*, New Series, Vol. XLVI, No. 1178, pp. 88-89. Lancaster, Pa., 1917.

During a field trip in Michigan in July 1914, the writer found a peculiar girdling of the stems and branches of field beans to be prevalent in several localities. Diseased specimens were collected from Kent, Newaygo, and Tuscola counties; since then, other specimens have been collected from various parts of the States each year.

The disease appears at the nodes of stems and branches as small water-soaked spots, which enlarge, encircling the affected parts; later the diseased areas become amber-coloured. This girdling is usually completed by the time the pods are about half mature. The affected tissue is so weakened that, from the weight of the tops, the stem breaks at the diseased node. These signs of the disease may appear before any evidence of the bacterial blight upon the pods.

Inoculations into stem nodes of healthy plants with a pure culture of *Bact. phaseoli* Erw. Smith, have produced typical signs of disease. Plants so inoculated showed the characteristic breaking at the stem node.

Plants inoculated in a similar manner with cultures of species of *Fusarium* and *Rhizoctonia* isolated from the diseased stem tissue, showed no girdling or breaking.

It seems likely that infection results from the washing of bacteria from affected cotyledons or leaves, to the axils of the leaves, but the method of entry of this organism is not yet worked out.

A more complete report upon this disease will be given by the writer at a later date.

**875 - *Xylaria* sp., the Cause of Root Rot in Apple Trees in North Carolina, United States (1).**

— WOLF, FREDERICK, A., and CROMWELL, RICHARD, O., in *Journal of Agricultural Research*, Vol. IX, No. 8, pp. 269-276, fig. 1-3, pl. 3. Washington, D. C., 1917.

Since 1913, a little-known root rot which causes the death of apple trees has been more or less continuously investigated in North Carolina.

The disease has been observed to occur in 7 counties of the State (Haywood, Wilkes, Polk, Alexander, Surrey, Warren, Henderson) and, in all probability, is the same malady which was already been noticed by FULTON and CROMWELL in Pennsylvania, and by FROMME and THOMAS in Virginia.

The symptoms manifested by the above-ground parts of affected trees (reduction in the number and size of the leaves, manifestation of chlorosis; the occurrence of excessively large sets of small fruits, which ripen prematurely, decrease in the annual increment of growth in the twigs, etc.) do not serve to distinguish this disease from other apple-rots.

The roots, however, are characteristically covered with black fungus incrustations, from the margins of which radiate minute, black rhizomorphs. The cortex is quickly corroded, and the roots are girdled, while disintegration of the woody portions proceeds slowly.

(1) See also R., June 1917, No. 604

(Ed.)

Isolations have constantly yielded a form whose conidial fructifications and stromatic arms indicate its relationship to *Xylaria* spp. On the roots of diseased apple trees perithecial stromata have been found which are morphologically exactly similar to *Xyl. hypoxylon*; it has not, however, been possible to determine whether this perithecial form is generally connected with the conidial stage which appeared in culture.

The cultural characters exhibited by the microorganisms when isolated from the diseased root of the apple tree are described in the article analysed.

In order to determine the parasitism of the fungus, inoculations with pure cultures were made at West Raleigh, N. C. in the roots of four apple trees selected for the purpose. Although relatively few inoculations were made, the organism was proved to be a vigorous pathogene.

876 - Diseases and Pests of the Plum-tree in Maryland, U. S. A. — See this *Review* No. 825.

877 - *Pestalozzia Lucae* n. sp., and *P. Feijoeae* n. sp., Melanconieae Parasitic on *Quercus Ilex* f. *agrifolia* and *Feijoa Sellowiana* respectively, in Tuscany, Italy. — SAVELLI, MARTINO, in *Bollettino della Società botanica italiana*, 1917, Nos. 6-7, pp. 62-68, 9 figs. Florence, 1917.

In March, 1917, near Marina di Pisa, some leaves of *Quercus Ilex* Linn. f. *agrifolia* A. De Cand. showed dry blotches of varying size, bounded by an extremely narrow, rusty-coloured band.

Here and there, on the dry portions of the leaf, could be seen small black spots which microscopical examination showed to be the fruiting organs of a *Pestalozzia*. The conidia have 4 septa and are furnished with 3 hairs, one being situated at the top of the upper chamber and the two others, which are recurved, towards the middle of the same. The species in question differs from *P. montellica* Sacc. and Vogl. and from *P. stellata* E. and E., which are also parasitic on the leaves of *Quercus* and is consequently described as new to science under the name of *P. Lucae*.

During the winter of 1914-15, some fruits of *Feijoa Sellowiana* Berg, stored in the laboratory of the Florence Botanical Garden, became covered with a fungoid growth which was also due to a *Pestalozzia*. the fructifications of which occupied practically the whole surface of the fruit, covering it with numerous conidia. The writer has followed the development of the fructifications and the germination of the conidia of this fungus which he classifies provisionally as a species new to science under the name of *P. Feijoeae*.

## INJURIOUS INSECTS AND OTHER LOWER ANIMALS.

GENERAL

878 - The Number of Races of Vine Phylloxera. — GRASSI, B. and TOPI, M., in *Rendiconti delle sedute della Reale Accademia dei Lincei. Classe di scienze fisiche, matematiche e naturali*, Series 5a. First Half-Year, 1917, Vol. XXVI, pt. 5, pp. 265-273. Rome, 1917.

The results of BÖRNER's experiments (1) led the authors to undertake similar research in the hope of solving the problem of the different ways in

(1) See B., August 1914, No. 799; B., October, 1915, pp. 1269-1290. (Ed.)



which phylloxera infection spreads in Italy. This infection sometimes spreads quickly or, at times, very rapidly, even in the northern districts, sometimes slowly, both in the northern regions and those fairly far south.

Knowing that gall-producing phylloxera is not the same in the American vineyards of Lake Superior as in the vineyards of Tuscany and Sicily, the authors undertook research on gall-producing phylloxera, which had developed on "Clinton" leaves in vineyards at Arizzano near Intra. The experiments were started in hot houses at Alice Bel Colle, which is not a vine-growing district, and continued at Nizza, Monferrato, a district already devastated by phylloxera, and considered as "zone abbandonate" (1). The gall-covered leaves were sent exclusively across contaminated regions and were subjected to no anti-phylloxera treatment. They were always enclosed in tin boxes, hermetically sealed and soldered, and done up in other covers, the last of which was soaked in formol.

The experiments were begun at the end of August, 1914, with two attempts at infection. For the investigations were used rooted cuttings of native vines, of "Riparia  $\times$  Rupestris 3306", "Riparia  $\times$  Rupestris 101.14", "Riparia tomentosa", "Mourvèdre  $\times$  Rupestris 1202", and "Bourisquou  $\times$  Rupestris 93.5"

"Clinton" leaves bearing galls were attached to the shoots and buried in the soil at the foot of the vines in order to cause infection. Both attempts failed, that is to say, there was neither formation of galls nor infection of the roots.

In August 1915, the attempt to infect cuttings in pots, by the above method by means of galls from Arizzano, was repeated. The plants used were "Riparia Gloire", "Riparia tomentosa", "Riparia  $\times$  Rupestris 3309", "Riparia  $\times$  Rupestris 3306", "Riparia  $\times$  Rupestris 101.14", "Berlandieri  $\times$  Rupestris 301 A", and rooted cuttings of native vines and of "Isabelle".

At the same time a comparative test was made with galls from the government nursery at Ventimiglia, thus repeating BÖRNER'S experiments, that is to say, attempting to infect similar varieties of vines, in identical environmental conditions, with gallicolae of different origins. For the experiment were used rooted cuttings of "Riparia Gloire", "Riparia  $\times$  Rupestris 3309", "Riparia Rupestris 3306", "Riparia  $\times$  Rupestris 101.14", "Aramon  $\times$  Rupestris G. No. 1", "Mourvèdre  $\times$  Rupestris 1202". The galls were chiefly taken from "Riparia  $\times$  Rupestris 3309" plants. As soon as the experiment, for which all the necessary precautions were taken, was finished, the vines were destroyed.

The rooted cuttings, especially those used in the Arizzano phylloxera experiments, were in the best possible condition for infection; numerous gallicolae were observed coming from the galls, and streams of these young insects were observed all along the cuttings.

(1) In Italy, "abandoned zones" are those in which the phylloxera had caused such havoc when the anti-phylloxera campaign was started, that no measures were possible. (Ed.)



Throughout the whole month of August no galls were noticed on any of the plants on which attempts at infection had been made with infected leaves from Arizzano. On September 7, therefore, the infecting material was renewed.

On September 16, two small galls were noticed on two young leaves of "*Riparia*  $\times$  *Rupestris* 101.14". They were about 2 mm. in diameter and were on leaves barely 2 cm. wide. Of these two galls, one remained very small, the other, near the edge, grew a little more. Later, all hope of a development of gallicola infection disappeared, the galls were opened and found empty. All the other vines were completely free from galls.

On the other hand, on the rooted cuttings infected with galls from Ventimiglia, the gallicola infection always spread on "*Riparia*  $\times$  *Rupestris* 3309" and "*Riparia*  $\times$  *Rupestris* 3306"; it did not develop either on "*Riparia* Gloire" or on "*Riparia*  $\times$  *Rupestris* 101.14" or even on "*Aramon*  $\times$  *Rupestris*" and "*Mourvèdre*  $\times$  *Rupestris*"; these last two vines, however, were not really in conditions of growth suitable to infection.

In October, a superficial examination was made of the root system of the rooted cuttings infected with the galls from Arizzano; the result was completely negative. The results of a more careful examination made in 1916 were also negative.

The rooted cuttings infected with galls from Ventimiglia were examined at the same time and in the same manner. The rooted cuttings of "*Riparia*  $\times$  *Rupestris* 3306" and of "*Riparia*  $\times$  *Rupestris* 101.14" were infected; those of "*Riparia*  $\times$  *Rupestris* 3309" had not given off roots; those of "*Riparia* Gloire" had given off roots, but they were immune; those of "*Aramon*  $\times$  *Rupestris*" and of "*Mourvèdre*  $\times$  *Rupestris*" had not given off roots. All these cuttings were destroyed immediately.

The experiments with galls from Arizzano were continued on the 18th. August, 1916, in order to attempt to infect, by the method and with the precautions mentioned above, pot cultures of rooted cuttings of "*Riparia* Gloire", "*Riparia*  $\times$  *Rupestris* 101.14", "*Riparia*  $\times$  *Rupestris* 3309" and "*Riparia*  $\times$  *Rupestris* 3306", and rooted cuttings of Italian vines. All were in the most favourable conditions of growth, and the infected material used for contamination was fairly abundant. Moreover, in a vineyard which was being utterly destroyed by phylloxera, gall-covered leaves from Arizzano were attached to shoots of a "*Clinton*" (?) and a "*Pinot*" growing quite near to each other.

Only one pot culture of rooted cuttings of "*Riparia* Gloire" was infected with galls taken from "*Riparia*  $\times$  *Rupestris* 3309" at Ventimiglia. Contrary to the results of the previous year's experiment, even on "*Riparia* Gloire", well-formed galls appeared, but they were small and few in number. A large number of punctures without formation of galls were also noticed. These vines were also destroyed after the experiment.

Infection with galls from Arizzano gave the following results: — complete immunity of leaves of "*Riparia* Gloire", "*Riparia*  $\times$  *Rupestris* 3309", "*Riparia*  $\times$  *Rupestris* 3306" and the pot cultures of Italian vines. As in the

preceding year, a few very small galls, which did not develop subsequently, were noticed on "*Riparia* × *Rupestris* 101.14".

A few small galls, which were soon emptied, appeared on "*Clinton*" (?) and Pinot.

An examination of the root system of the vines in pots made on the 24th. September, showed that all the American vines ("*Riparia Gloire*", "*Riparia* × *Rupestris* 3 309", "*Riparia* × *Rupestris* 3 306", "*Riparia* × *Rupestris* 101.14) were immune, but all the native vines were infected.

The results obtained from these experiments lead to the following conclusions: with phylloxera galls from "*Clinton*" it was not possible — in three consecutive years — to infect either the leaves or the roots of the various American vines, which, as a rule, are capable of contracting galls and nodules. Galls and nodules are developed if material taken from other vines in other districts is used. Of all the vines used in the experiment, only "*Riparia* × *Rupestris* 101.14" showed a certain facility for producing galls, though none of these were fertile. Galls are produced more easily on identical or similar vines ["*Clinton*" (?)]. In Italian vines, the formation of galls is not the same for every variety (Piedmontese vines in pot cultures and "*Pinot*" vines in vineyards).

Following the hypothesis of BÖRNER it would seem that, at Arizzano, there is a race of phylloxera closely resembling that of Lorraine, with the sole difference that the Arizzano phylloxera produces sterile galls on leaves of "*Riparia* × *Rupestris* 101.14" without infecting the roots, whereas this same vine, infected with Lorraine phylloxera, showed no sign of galls, but a consistent infection of the roots.

The following hypothesis, however, seemed to the authors to be more just: is it not possible that, to continue the cycle to the winter egg, the winged insects, at least in a general way, lay on the leaves or bark of the same vine (or neighbouring vines) on whose roots they developed, and that the passage of the gallicolae from one vine to another, and, consequently the formation of galls, are regulated by conditions hitherto unknown (varieties, predetermined biotypes of vines)?

This hypothesis is confirmed by another series of tests and observations.

On the roots of the European vines infected by phylloxera, the winged form, which contributes to the dispersal of the insect, develops more or less rapidly according to the various conditions, especially climatic ones. On the contrary, as has been noted, the gall-producing form does not generally appear on Italian vines. What, therefore, is the fate of the insects which, particularly in the infected vineyards of Upper Italy, are produced in such great abundance? Does the gallicola, on leaving the winter egg and finding no vine suited to the production of galls, disappear and die? Or, not guided by instinct, do they disperse without laying eggs, or lay them in any place, so that the sexual insects only meet with difficulty?

In 1915, in order to solve these questions, two plants in a vineyard already devastated by phylloxera, were covered with material, so as to form a sort of cage with very close meshes. The two vines chosen were a "*Clinton*" and a native one, which happened to be in the vineyard. Twice a



day, from the 10th. August to the 24th. September, as many nymphs and winged forms as possible were brought to these cages. The nymphs were collected from the roots of infected vines and introduced into the cage in glass jars without being separated from the roots which they were attached. The winged forms were taken from spider webs, which are very numerous in the Monferrato vineyards, and detached from the web so that they could move and fly freely; they were also enclosed in glass jars, which were opened when they were put in the cage. In the cages were also placed several hundred nymphs, all of which had not reached maturity, and, consequently, all were not capable of transforming, and winged forms, all of which were not viable and in a condition to lay eggs.

At the same time winged forms, the eggs of sexual insects, sexual forms and winter eggs were looked for under the leaves and on the stems of vines affected by phylloxera. The result was always negative for native vines; the winged forms could easily be seen on the ground.

In captivity the winged forms lay their eggs freely, and it is easy to obtain living and mobile sexual forms.

Towards the end of August winged forms and sexual forms were looked for in vain under the leaves of two covered vines and under the bark of their stems. The results was completely negative. During the winter the "Clinton" tree was not even pruned. No winter eggs were found on the native vines in the infected vineyards.

In the spring of 1916, contrary to expectation, no galls had formed either on the Italian vine or the covered "Clinton".

It is difficult to account for this absence of gallicola infection. It may be assumed that "Clinton" (?) of uncertain origin, is not capable of bearing galls, and, for this reason, both on this plant as on other native vines, the gallicolae hatched from the winter eggs are lost. It might also be assumed that, to produce the infection, it is necessary, not only that the plant should be capable of producing galls, but that infection should first occur in the roots, or that galls, either from the same vine or from specified vines, should be used. This hypothesis would explain the experiments already described and is supported by a fact observed in the same vineyards: In the vineyard, which had been almost totally destroyed by phylloxera, there were, here and there, different varieties of wild American vines, and about 20 adult direct bearers, but there was no sign of infection. If the American vines or the hybrids had had any sort of attraction for the winged insects, infection could not have been absent.

In September 1916, under the leaves of the above-mentioned "Clinton" (?), three winged insects were found. This had been observed in no other experiment. It should be noted that the roots of the "Clinton" (?) had probably been immune up to the preceding year, when they had become infected. This would explain the presence of the winged insects.

From a general point of view it is known that gallicola infection always appears in a country or district after (and even many years after) radicola infection (Sicily, Piedmont, Apulia, Tuscany). Could not this be explained by admitting the passage through the roots of American vines to



be necessary? If these vines attract winged insects of any origin, it would not be difficult to explain the absence of galls in vineyards of stock plants of American vines bordering on phylloxera-infected belts, as occurs in so many nurseries in Apulia.

879 - *Pectinophora Gossypiella* (Pink Bollworm) a Microlepidopteron Injurious to Cotton, and *Pyroderces Rileyi* (Scavenger Bollworm) another Microlepidopteron which May Easily be Mistaken for the Former (1). — BUSCK, AUGUST, in *Journal of Agricultural Research*, Vol. XI, No. 10, pp. 343-370, fig. 1-7, pl. 7-12. Washington, D. C., 1917.

The pink bollworm is one of the most destructive cotton insects known in many parts of the world. This species has been placed by European specialists in the genus *Gelechia* (*G. gossypiella* Saunders), though it is very distinct from the genus (fam. *Gelechiidae*) both in the imago and as larva and pupa. For this reason, a new genus has been proposed for it and for the closely related *P. malvella* Zeller, the larva of which feeds in the seeds and capsules of *Althaea* and *Malva* in Europe.

Although the species (*Gelechia*) *Pectinophora gossypiella* Saunders was first noticed and described from India, it is probably of African origin.

The insect has spread to most, if not all, the cotton districts in Africa, Asia, Japan, Ceylon, Straits Settlements, Philippines and the Hawaiian Islands. Within the last few years, it has been introduced into the American continent and is already established in Brazil and Mexico. Thanks to the regulations requiring the fumigation of all foreign cotton, this pest has not yet become established in the United States. The necessity of this precaution will easily be seen when we consider that the introduction of this insect into the cotton areas of the United States would entail an annual loss of millions of dollars.

A thorough knowledge of the insect in all its stages is necessary, in order that the agents employed to prevent its introduction may be able to recognise it, even from fragments. The detailed description given in the paper analysed provides this means of identification. The account is based on an investigation of *P. gossypiella*'s life history and habits conducted in the Hawaiian Islands during the summer of 1915, and subsequent anatomical studies made from material from various sources. A list of the insect host-plants is also given (from the observation of the writer it appears only to attack members of the genus *Gossypium*), together with its natural enemies, synonyms, etc.

The writer also describes another microlepidopteron, (*Batrachedra*) *Pyroderces rileyi* Walsingham, popularly known as the "scavenger bollworm" because it lives as a scavenger in the more or less decayed dry bolls injured by other insects. It occurs in North and South America, the West Indies and the Hawaiian Islands. It seemed desirable to the writer to add to this paper a similar description of this insect, so that the anatomical details may make it possible for the inspector to distinguish readily between it and

(1) See also *B. March* 1913, No. 203: *B. September* 1913 No., 1119: *R. June* 1916, No. 714: *R. August* 1916 No. 952. (Ed.)

*Pect. gossypiella* for which it has frequently been mistaken. A bibliographical list of 40 publications is appended to the article.

880 - **The Use of Nicotine Sulphate as a Spray.** — MOORE, WILLIAM and GRAHAM, SAMUEL A., in *Journal of Agricultural Research*, Vol. X, No. 1, pp. 47-50. Washington D. C. 1917.

The attention of the writers was directed recently to 2 cases of nicotine poisoning observed at Minnesota (United States) and resulting from the use of greenhouse lettuce (*Lactuca sativa*). The plants had been sprayed with a commercial tobacco extract containing 40 per cent. of nicotine sulphate.

The writers found from their experiments that, while nicotine is volatile, nicotine sulphate is non-volatile. The alkalis contained in hard water and soap set free the nicotine contained in nicotine-sulphate sprays. In order to obtain the maximum efficiency of tobacco extracts containing nicotine sulphates, they should be rendered alkaline before using. Commercial tobacco extracts containing nicotine sulphate should not be used in the greenhouse, at least not on plants which are later to be used as food. Tobacco extracts, or tobacco papers containing free nicotine, may be safely used in the greenhouse on plants such as lettuce, without danger for the consumer. Food plants, such as lettuce, sprayed with tobacco extracts, should not be cut for the market until the day after spraying. If the temperature of the house is low, a longer period should be given to allow the nicotine to evaporate completely from the leaves.

881 - **Experiments on the Control of "Eudemis" and "Cochylis" (*Polychrosis botrana* and *Conchylis ambigua*) in Piedmont, Italy** (1). — TOPI, MARIO, in *Rendiconti delle sedute della Reale Accademia dei Lincei, Classe di Scienze fisiche, matematiche e naturali*, 5th. Series, 1st. Half-Year 1917, Vol. XXVI, Part 4, pp. 258-261. Rome, 1917.

In a vineyard at Alice Bel Colle (province of Alessandria), where muscat is the predominant grape, one or more bands of different kinds were placed on the stems of about a thousand vines, or on the cane supports at varying heights, the bands being chiefly made of rag, leaves and spathes of maize. These latter were intended to harbour the larvae after they leave the grapes in order to pupate instead of their going beneath the bark as they would probably do otherwise. This was done in mid-September, 1915.

In January, 1916, all the bands were detached from the vines, and the last internode of each cane, which might serve as a refuge for the chrysalides, was removed.

Only a small portion of the material however, could be examined and the number of chrysalides was small.

In spring, the same thousand vines were given a couple of treatments with arsenate of lead and, in summer, a further two with tobacco juice; in order to perform these treatments use was made of the copper sulphate

(1) See also *B. June* 1915, No. 665; *R.*, June, 1916, Nos. 708-709; *R.*, July, 1916, No. 829. (Ed.)



sprayer, this latter being provided with an intermittent jet. An effort was made to spray only the grapes, but the labourer was not required to be excessively careful, in order to keep the work within the limits of actual practice.

For the first treatment (May 15), a solution of lead arsenate was used, at the rate of 800 gr. per hectolitre. For the second treatment (May 30), 1 kg. of arsenate was added to 1 hl. of ordinary Bordeaux mixture; and in order to increase its adhesiveness about 100 gr. of casein was added to each hl. of the mixture. The third treatment was effected on July 19 with tobacco juice at the rate of 2 %, to which was added 100 gr. of soft soap; at the beginning of the treatment a certain number of leaves were removed from the whole of the vines in order better to expose the grapes. At this period the eggs of *Polychrosis* and *Conchylis* were very rare upon the vines under experiment; they were slightly more numerous outside the zone of the experiment; a few very small larvae of *Conchylis* had already penetrated the grapes. The fourth treatment was carried out on July 31 with tobacco juice and soap in the same proportions as before. At this period, both in the experimental portion of the vineyard and in the check portions, the larvae had penetrated the grapes but were only present in small numbers. The eggs also were invariably limited in number.

The same day, in another vineyard, an experiment was made with lead arsenate in powder form, a row of vines being treated with sulphur with 5 % of lead arsenate added.

As in the previous experiments, the results were reckoned by collecting all the grapes which were gnawed or spoilt from one or more vines, treated or not, and counting the larvae contained therein and determining the different species. The choice of the vines to be examined was made in such a way that the quantity of grapes found on each was about the same whether they were treated or not. Care was taken to select the vines in the same row because, as is known, the quantity of parasites and the relative numbers of *Polychrosis* and *Conchylis* vary considerably according to whether the observations are made in the low part or in the upper portion of a vineyard situated on a slope.

The writer's results show that, in a year of little infection, as 1916 for instance, with the winter operations outlined above, with two spring treatments on a lead arsenate basis and two in summer on a basis of tobacco juice — the whole effected without really special precautions — at the end of August a reduction was obtained in the number of larvae equivalent to from 71 to 85 %, to which there corresponded, at the same period, a reduction in the number of spoilt grapes varying from 52 to 84 %.

The treatment with lead arsenate in powder form caused a reduction of 40 % in the number of larvae and of 21 % in that of spoilt grapes. The writer, however, makes every reserve with regard to the innocuousness of such arsenical treatments in summer whenever they have to be effected on a large scale.



- 882 - **Life History of *Plutella Maculipennis*, the Diamond-Back Moth** (1). — MARSH, H. D., in the *Journal of Agricultural Research*, Vol. 10, No. 1, pp. 1-9; plates 1-2. Washington, D. C., July 2, 1917.

*Plutella maculipennis* Curtis (fam. Yponomeutidae) is a cosmopolitan species widely distributed in the United States. From 1908 to 1916 it was observed successively in California, Texas, Colorado, Louisiana, Hawaii, North Carolina, New Jersey, Arizona and New Mexico.

The larvae of this moth appear to infest exclusively cruciferous plants. They have been observed on the following plants:

Cabbage (*Brassica oleracea capitata*); Cauliflower (*B. oleracea botrytis*); turnip (*B. Rapa*); radish (*Raphanus sativus*); rape (*B. napus*); kale (*B. oleracea acephala*); mustard (*B. nigra*); Chinese mustard (*B. juncea*); kohlrabi (*B. oleracea caulorapa*); watercress (*Radicula sinuata*); horse-radish (*R. Armoracia*); sweet alyssum (*Koniga maritima*); candytuf (*Iberis amara*); wild watercress (*Roripa sinuata*), and hedge mustard (*Sisymbrium* sp.) With the exception of cabbage, cauliflower and rape, these plants, as a rule, suffer little injury from the attacks of the larvae.

At Rocky Ford (Colorado) there are seven generations of *P. maculipennis* annually. The life cycle, from egg to adult, lasts from 16 to 47 days. In the southern States this insect is active throughout the year. Although it develops with remarkable rapidity and is capable of causing extensive damage if unchecked, the insect is usually effectively repressed by natural enemies, particularly by an ichneumon, *Angitia plutellae* Vier., a parasite of the larva. Should the parasites become inactive and the larvae of *Plutella* increase sufficiently to demand attention, they may be readily controlled by arsenical sprays (Paris green, arsenate of lead).

- 883 - **The Chief Insects Injurious to the Cotton Plant in the Punjab, India.** — MOHAN, LALL MADAN, in *Department of Agriculture, Punjab, Some Important Insect Pests of Cotton in the Punjab*, 1917, 8 pp. 3 coloured plates. Lahore, 1917.

The cotton plant is subject to the attack of various insects, but only 3 of them cause serious injury to the crop. These appear regularly every year and infect the bolls, thus reducing the yield. They are: the macrolepidopteron, *Earias insulana* Boisd. (cotton bollworm) and the rhyncotes *Dysdercus cingulatus* Fabr. (red cotton bug) and *Oxycarenus laetus* Kby (dusky cotton bug). These three pests are easily recognised in the field.

The object of this short paper is to inform cotton growers of some simple means of controlling the above-mentioned parasites.

- 884 - ***Schizura ipomeae*, a Macrolepidopteron Parasitic on Rose Bushes and Pecan Trees in Louisiana, United States.** — TUCKER, E. S., in *The Canadian Entomologist*. Vol. XLIX, No. 8, pp. 280-281. London, August 1917.

On October 4, 1913, the writer collected on rose leaves at Baton Rouge La., 3 specimens of a caterpillar which, when the adult insect emerged from one of the cocoons (Jan. 28, 1914), proved to be the "bindweed prominent" (*Schizura ipomeae* Ddy).

At the same place on September 15, 1914, similar larvae were taken while feeding on rose leaves.

On September 16 of the same year, at Ferriday, Concordia Parish, La., the writer observed slight damage caused by apparently the same species of caterpillar on pecan foliage (*Carya olivaeformis*). On September 29, a correspondent at Newroads, Pointe Coupée Parish, La., sent similar specimens, complaining that the larvae in question were eating the foliage of his young pecan trees; he added, however, that the insects had only attacked the trees which had been planted out the preceding winter, and that they seemed to prefer the less vigorous growth. The writer advised the use of an arsenical spray, should the trouble become serious.

On August 3, 1915, Mr. TUCKER noticed a caterpillar of the same lepidopteron on a rose bush belonging to a florist, at Hammond, Tangipahoa Parish, La. As the grower had made a practice of picking off and destroying all such parasites on his plants, he had kept his stock free from ravages.

On October 30, of the same year the larvae of *Schizura ipomeae* were reported as destroying rose bushes at Plaquemines, Iberville Parish, La.

885 - *Phenacoccus pettiti* n. sp., a Scale Insect Observed on Several Useful Plants in Missouri and Kansas, United States. — HOLLINGER, A. H., in *The Canadian Entomologist*, Vol. XLIV, No. 8, pp. 281-284, fig. 24-27. London, August, 1917.

A systematic description of the new species found on the following plants upon which it feeds: *Ambrosia trifida*, *Psedera quinquefolia*, *Rhus Toxicodendron*, *Cercis canadiensis*, *Symphoricarpos orbiculatus* and *Fraxinus americana*. The insect has also been collected from *Celtis occidentalis*, *Carya ovata*, *Ostrya virginiana* and *Acer saccharum*. It is common in the State of Missouri (counties of Gentry, Jackson and Boone) and has been recorded as occurring also in Kansas.

886 - Chalcididae Living in the Fruits of Wild Fig-trees in Eritrea and Uganda (1). — GRANDI, G., in *Bullettino della Società entomologica italiana*, Year XLVIII (1916), 42 pp., 12 figs. Florence, 1917.

A systematic description of the following hymenoptera:

1) *Blastophaga allotriozoneoides* Grandi, collected at Ghinda (Eritrea); the specific name of the host fig-tree is unknown;

2) *Ceratosolen arabicus* Mayr, living in the fruits of *Ficus Sycomorus* Linn., at Keren and at Ghinda;

3) *C. megacephalus* Grandi, collected at Busso Busoga (Uganda): the name of the host fig-tree is unknown;

4) (?) *Sycophaga Sycomori* (L.), collected at Keren, Ghinda, Asmara (Eritrea), seems to live exclusively in the fruits of *F. Sycomorus*;

5) *S. Silvestri* Grandi *tenebrosa* Grandi, collected at Busso Busoga, the plant host is unknown.

(1) See also R., Nov. 1916, No. 1251 and R., April 1917, No. 391.

(Ed.).

887 - *Agrilus burkei* n. sp., a Coleopteron Parasitic on *Alnus rhombifolia* and *A. tenuifolia* in California. — FISHER, W. S., in the *Canadian Entomologist*, Vol. XLIX, No. 8. pp. 287-289. London, August 1917.

In the article analysed, a new species of buprestid, *Agrilus burkei*, discovered at Placerville (California), is described from a systematic point of view. Its larva excavates galleries in the cortex and wood of healthy, diseased and dying trees of the two species, *Alnus rhombifolia* and *A. tenuifolia*.

This coleopteron is very nearly related to *A. politus* Say, from which it chiefly differs in colour and in its habits.



INTERNATIONAL INSTITUTE OF AGRICULTURE  
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FIRST PART.  
ORIGINAL ARTICLES

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**Present State of Sheep Breeding in Canada.**

by

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Sheep raising is fast becoming one of the most important branches of live stock production in Canadian agriculture. The climate is most conducive to thrift in sheep, and conditions of agriculture obtaining here, although varying in the different provinces, are, in most respects, adaptable to the successful prosecution of some system of sheep farming. In fact, few countries of similar area possess so many natural advantages for sheep breeding, which may be carried out in some parts of the country in form of extensive ranching and in others, of intensive small flock farming.

For many years sheep raising in Canada lay dormant. From 1890 to 1910 an actual decrease occurred in sheep population and the average farmer appeared to lose all interest in this industry. Many reasons can be attributed to the assumption of this attitude: 1) extremely low price of wool; 2) serious depredations by dogs and, in the Western provinces, by coyotes, without adequate control of these animals and reimbursement for losses; 3) haphazard marketing methods of both wool and mutton; 4) lack of governmental recognition of the potential importance of the industry; and 5) serious annual depletion of the best breeding stock through exportation. Up to 1910 the industry was altogether looked upon as a side issue in Canadian farming. Passing interest alone was taken in it and this of the most cursory type. Then a shortage occurred, so that the industry could not adequately supply domestic needs and with the prevailing high prices the necessity of reinvigorating the industry became most apparent.

It is worthy of mention in this respect that during the period of the depression Canada was winning, in many instances, the bulk of the prizes in the long and medium-wooled classes for sheep in American Stock shows, and was demonstrating the native ability for breeding and feeding sheep.

Canadian sheep breeders were always at the fore in International Exhibitions on this continent, much more so than in any other line of live stock production, which caused the impression that this was the most important branch of the live stock industry. This reputation, however, was gained and upheld by about twenty breeders, who did produce and fit a most superior class of sheep, covering all of the most prominent mutton breeds. They were showmen and breeders of high merit; they did not represent the average sheep-raiser. Their sheep were eagerly sought by American buyers and few were retained in the country to improve the Canadian breeds. In fact, unfortunately it might be said that they catered directly to the United States market where their influence and reputation was wide spread; in Canada it was seldom more than local.

Conditions since 1910 have changed. The attitude of the big breeder has changed, along with allied interests and the government. Canada's position as a sheep raising country has been made clear. The awakening came with a recognition of the dearth of superior stock in the country, subsequently emphasised by the war. The federal and provincial governments early took up the problem of replenishing and improving the stocks. Those breeders who formerly had been exporting to the United States observed the necessity of reserving their animals for domestic breeding. More effective dog and wild animal laws were passed, which placed the industry on a safer basis. The federal government initiated a scheme of cooperative selling of sheep products, which gave to the producer a fair return of value in marketing.

A review of this cooperative work with wool will be helpful in showing the advance which has occurred in this respect. It began after due investigation in 1912 and is supported by the federal department of agriculture. Up to this time, medium wool (about a 50 in spinning qualities) had sold by the producer at approximately eight cents per pound. The reasons for this condition are: 1) improper preparation of the fleece to suit the market demands; 2) purchase by dealers on a flat basis—same price for dirty as for clean; for fine as for coarse; 3) a tariff on cloth and actually none on wool or tops. Under the old system of marketing, the wool passed through many hands before it ultimately reached the consumer. Under the present system the producer sells directly to the mill. Besides, the wool is classified, which places a premium upon efficient production and preparation. This method of selling has increased rapidly. In 1914, following an educational campaign in 1913 to prepare the way, 206 129 pounds of wool were graded and sold by societies organized in four provinces, namely Quebec, Ontario, Manitoba and Alberta. In 1915 the number of organizations formed for this purpose was increased to nineteen. Approximately 420 000 pounds of wool were classified and offered for cooperative sale. In 1916 this amount had reached the total of 1 721 598 pounds with a value of \$ 579 678.69 and every province was represented. This amount in 1917 will probably surpass 4 000 000 pounds. Small collecting depots have been established throughout the country and a central warehouse, controlled and operated by the Federal Govern-



ment, has been located at Toronto, the centre of textile manufactures for Canada. Here wool is shipped, classified, stored and sold by auction. Financial facilities, through regular banking channels, have been accorded to the producers, whereby they are enabled to obtain upon shipment a 75 per cent. monetary advance upon a fair appraisal by government agents. It is expected that the entire Canadian wool clip will ultimately be disposed of in this fashion.

These cooperative associations are composed solely of sheep-raisers who are responsible for and control wholly, their own business affairs. A salaried manager or secretary is appointed from among themselves. The federal government, however, performs or supervises the classification of the wool and other sheep products and provides storage and selling facilities at cost price. No compulsion rests on the part of the government except in so far as the grading of the product is concerned. It is the purpose in this respect to create a standardized Canadian article especially for export but for interprovincial trade as well.

Sale of sheep on the hoof for the shambles and for breeding purposes is also being carried out in similar fashion by these associations. In this regard, the federal government encourages the conservation of breeding females. Should a society find it incumbent, for reasons of a surplus in the district or the necessity of liquidation, to dispose of females suitable for retention as breeders, the government provides facilities for retaining these animals until a suitable purchaser is found in another section of the country. Besides, the federal department of agriculture loans sires to associations of breeders in localities where the farmers are financially unable to obtain purebred rams of first-class type. The government maintains a supervision of the breed which shall be used by any association and persistence to the original selection is insisted upon. This tends to create uniformity of type in a district and represents an advance toward the community system of breeding.

The spirit of cooperative effort has extended, since inception, to other phases pertaining to sheep management and production. The purchase of necessary supplies such as feeds and dipping, or shearing apparatus, represents another feature. Community dipping and shearing are also making rapid progress. Sheep-raisers are finding it much more profitable and effective to work together and pool their activities rather than continue as formerly under the system of individualism. However, it must be pointed out that all development tending in this respect comes solely from the farmers themselves, and governmental action depends entirely upon their advice and recommendation and is responsible to their direction.

The increase in the number of sheep in Canada since the rejuvenation period began in 1910, has not been great. This is due to the outbreak of the great war and the demands created by it for men and sheep products. There are now over 2 250 000 sheep in the country, which represents an increase of about 200 000 since 1914. Upon a return to normal conditions it is confidently predicted that rapid progress will take place. This popu-



lation is scattered fairly uniformly over all the provinces except Ontario, where about 40 per cent. of the total are raised. Under ordinary conditions, Canada did produce about 75 per cent. of its mutton consumed, the remainder coming mostly from Australia and New Zealand. A small reciprocal trade occurs with the United States, which generally forms a more or less complete balance and depends upon the variations of border markets. For instance, one week the Toronto market may be a degree higher, for purely local reasons, than the Buffalo, and consequently shipments will come from Buffalo, a short, four-hours' journey, or the reverse condition may exist. Wool production scarcely more than equals 50 per cent. of the consumption. However, in this respect some grades, the coarse and lustre, are produced here which are not to any degree consumed and not sufficient of the fine classes are raised. The reason for this is that conditions of agriculture make Canada inherently better adapted for the production of a mutton type of sheep than the Merino or essentially fine wool breeds, and the market demands placed upon the mills does not render it profitable for them to utilize the coarser grades at a price which can be gained for them in export. However, the coarse-wooled type of sheep is losing prevalence and the distinctly medium-wooled or "Down" breeds are attaining the greatest prominence and soon will monopolize the market. These produce the class of wool and mutton most acceptable to the domestic trade.

Breeds raised to the greatest degree in Canada belong to the "Down" classes of British origin, namely, the Oxford Down, Hampshire and Shropshire. These breeds represent the foundation stock of the country. The Suffolk Down and Southdown are also bred to a limited degree and are chiefly used for crossing purposes to attain perfection of mutton type and in the case of the Suffolk early lamb, maturity. The Dorset Horn is raised fairly extensively in proximity to cities for the purpose of winter or "hot-house" lamb production. This breed is especially adapted for this form of sheep husbandry, since it possesses the innate quality of taking the male at virtually any period of the year. The Cheviot of Scottish origin is being used in the rough, rocky and hill sections in Northern Ontario and Quebec. Its ability to range and thrive under a state of comparative neglect makes it especially satisfactory for breeding in these districts. The long-wooled British breeds of Lincoln, Cotswold and Leicester were prominent at one time and represented the first breeds to be imported. However, as already explained, the tendency now is toward a medium-wooled mutton sheep and the former have lost their ascendancy, being slowly supplanted by the latter. The Merino, such as the Rambouillet or Delaine, are used only for crossing purposes upon sheep of mutton character, ranged in large flocks over wide areas in the dry farming belts of Saskatchewan, Alberta and British Columbia. The infusion of Merino blood gives the gregariousness and rustling qualities so essential under these conditions. It is found that the British breeds are well adapted to the Canadian climate and agriculture. They are, consequently, being bred in a pure state and confined to areas similar to their place of origin. There

*Numbers of sheep in Canada, from 1871 to 1916.*

	10-year census from 1871 to 1911					Annual statistics from 1912 to 1916				
	1871	1881	1891	1901	1911	1912	1913	1914	1915	1916
<i>Whole of Canada</i> . . . . .	3 155 509	3 048 678	2 563 781	2 510 239	2 175 302	2 082 381	2 128 531	2 058 045	2 038 662	1 965 101
<i>Provinces:</i>										
Prince Edward Island.	—	166 496	147 372	125 546	91 232	87 793	85 660	85 351	86 640	88 797
Nova Scotia . . . . .	398 377	377 801	331 492	285 244	220 907	216 135	217 734	211 921	205 542	200 979
New-Brunswick . . . . .	234 418	321 163	182 941	182 524	158 216	148 723	135 115	211 739	111 026	105 997
Quebec . . . . .	1 007 800	889 833	730 286	654 503	637 062	620 881	662 751	571 287	554 491	497 711
Ontario . . . . .	1 514 914	1 359 178	1 021 769	1 046 456	743 483	677 462	705 848	640 416	611 789	589 581
Manitoba . . . . .	—	6 073	38 838	29 464	37 322	40 800	42 840	45 303	50 880	51 943
Saskatchewan . . . . .	—	—	—	66 048	114 216	114 810	115 568	126 027	133 311	138 350
Alberta . . . . .	—	—	—	87 104	133 592	135 075	178 015	211 001	238 579	245 474
British Columbia . . . . .	—	20 172	32 105	33 350	39 272	40 702	45 000	45 000	46 404	46 269

is no apparent necessity, therefore, to create purely Canadian classes of sheep except where ranching obtains in Western Canada.

A control of the distribution of the British breeds mentioned is expedient and is being carried out. For instance, it would be inadvisable to raise the Oxford Down in a mountainous region. Such a region is plainly the place of the Cheviot. Experiments, however, are under way to discover and produce a type of sheep, purely Canadian and suited for ranching purposes in the Western Provinces. The ultimate product will comprise some cross of the Merino with the essentially mutton types.

Sheep are raised in small flocks, averaging twenty-five head, in the Eastern provinces and Manitoba, except for a limited degree of ranching in Northern Ontario and Quebec, where an average of 1000 head will comprise a flock. In Northern Saskatchewan, Alberta and British Columbia, except the undeveloped section of the latter, the same character of sheep raising is pursued. In the remaining parts of these provinces ranching of sheep in flocks as high as 15 000 head is carried on profitably. Ranching occupied a much more prominent position than it does today. The homesteader or settler is slowly taking up the land, with the aid of irrigation where necessary, and encroaching upon what were the preserves of the rancher so that he is compelled to restrict the size of his flock. However paradoxical it may appear, this condition makes for an increase in sheep population. Where the rancher carried one sheep on many acres, the farmer will raise several sheep per acre and the animals will be of a higher character.

For some years Canada will not be an exporting country of sheep products. That it eventually will be and on a large scale is assured. It soon will supply the demand for home consumption in mutton. The finer grades of wool will always be imported, but shortly an offering for export in relatively large quantities will appear of the medium and coarse classes, since, when settled, the boundless areas of uncultivated fertile farming lands which exist, will cause agriculture and its kindred industry, live stock production and especially sheepraising, to develop at a greater pace than the establishment of those classes of manufacture upon which the progress of agriculture is not strictly dependent.

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## SECOND PART.

# ABSTRACTS

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## AGRICULTURAL INTELLIGENCE

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### GENERAL INFORMATION

888 - **Agriculture in the Dominican Republic.** — ZIELINSKI, C. M. J., in *Supplement to Commerce Reports*, Annual Series, No. 26a., pp. 1-3. Washington, D. C., May 5, 1917.

The Dominican Republic has an area of nearly 20 000 square miles, being about twice the size of the Republic of Haiti or more than five times that of Porto Rico. The latest estimate of the population is 700 000. The fertility of the land, which is mainly in the virgin state, presages the possibility of immigration and consequent development provided, of course, other factors remain equal.

The climate of the country is healthy, like that of Porto Rico and other large islands in the West Indies. Trade winds blowing most of the year make the nights cool, and only a short part of the day can be called hot. From early December until June there is very little rain, and the weather is therefore ideal for the grinding of sugar cane. Considerable rain falls in the central and northern part of the Republic, especially in the vicinity of Samana Bay, which is probably the most fertile section of the entire country. In 1916 was recorded an abnormal rainfall for the southern section, when the precipitation from October 1 to November 23 totaled 22.67 inches, more than three times that of 1915 and about seven times that of 1914.

One of the most important products of the Republic is sugar, produced mainly in the southern half. The 1916 crop, although about equal to that of 1915, brought excellent profits. The 1917 crop, estimated at about 150 000 long tons, is considerably more than the one preceding. The increase is suggestive as to the immediate future. This island lies between Cuba and Porto Rico, both of which are large sugar producers. If it is considered that the local industry is able to increase its exports to the United States while paying the full import duty in competition with the 20

DEVELOPMENT  
OF  
AGRICULTURE  
IN DIFFERENT  
COUNTRIES

per cent. reduction of duty on sugar from Cuba, and even against free importation from Porto Rico, it will be recognized that the conditions are good, to say the least. A new sugar plantation was established during the year. Negotiations are now on foot to utilize the land near Barahona for the growing of cane, and it is probable that the entire southern part of the island will be devoted to the sugar industry.

Another product is coffee, of which Santo Domingo exports more than any other Dominican port. Cacao is the chief product of the northern half, and much of it is grown around Samana Bay and shipped from Sanchez. Tobacco is grown mainly in the central part and exported chiefly through Puerto Plata. The grade of tobacco raised is good, although its quality is diminished by careless growing and curing. The value of the crop as a means of widely distributing money among the people is great, thus inducing a more general prosperity.

The following table shows sections of the Republic producing the four main crops, which comprise 90 per cent. of the total exports of the country. It also contrasts the value of the product in each locality with the figures of the previous year.

Ports	Cacao		Coffee		Sugar		Tobacco leaf	
	1915	1916	1915	1916	1915	1916	1915	1916
	\$	\$	\$	\$	\$	\$	\$	\$
Azua . . . .	—	—	37 479	21 576	284 051	545 279	—	—
Barahona . . .	—	—	9 179	12 924	—	—	—	1 108
Comendador . .	—	—	—	—	—	—	20 704	2 575
Dajabou . . .	—	—	—	—	279	—	14 380	2 356
La Romana . .	260 889	112 654	163	—	—	—	—	—
Las Lajas . . .	—	—	11	—	—	—	—	—
Macoris . . . .	234 016	279 000	1 022	—	6 071 120	9 616 024	660	122
Monte Cristi . .	1 756	—	7 233	3 302	95	—	15 490	86 955
Puerto Plata . .	924 113	916 950	145 357	99 378	—	3 421	649 900	853 704
Samana . . . .	208 876	187 735	—	—	—	—	—	—
Sanchez . . . .	2 964 642	4 249 970	47 146	13 564	—	—	271 652	478 077
Santo Domingo	269 462	212 360	210 842	166 083	1 315 838	1 863 573	110	8 526
Totals . . . .	4 863 754	5 958 669	458 431	316 827	7 671 383	12 028 297	972 896	1 433 423

The Dominican Republic has rich forests, which are hardly diminished by the drafts made during the four centuries since its discovery. The wooded area is estimated at 9 500 000 acres, about 85 per cent. of the total land surface. Mahogany was formerly exported in considerable quantities and is known for its excellent quality. Pine covers a large area in the central and southwest parts. Lignum-vitæ is plentiful, especially in the south. There are immense quantities of dyewood in the interior. According to reliable reports, the north seems favoured with a greater quantity and the south seems to have the better quality. The scarcity of

dyes in the United States has prompted many local firms to take advantage of the conditions and much logwood has been shipped to American markets.

889 - **Agriculture in the Philippines.** — *Commerce Reports*, No. 154, pp. 28-31. Washington, D. C., July 3, 1917.

Few authoritative figures have ever been published regarding agriculture in the Philippines. This fact lends special importance to data collected by the Philippine Bureau of Agriculture and now made public by the Bureau of Insular Affairs at Washington.

The total area of the Philippines, including in all 3 141 islands, islets, and reefs, has been reported by the Manila Observatory to be 119 542 square miles, which is equivalent to 30 961 500 hectares (1); but the area under cultivation in the six principal crops and three minor ones in the year ended June 30, 1916, was only 2 621 077 hectares, or 8.5 per cent. of the whole area of the islands. Rice was grown on 1 140 829 hectares, abaca on 500 317, corn on 432 766, coconuts on 275 769 (the average planting being 200 trees per hectare), sugar cane on 179 761, tobacco on 58 913, and maguey on 30 804 hectares. There were 1 074 hectares devoted to cacao and 844 to coffee.

The reported yield from this area and the value of the crops (expressed in Philippine pesos of \$ 0.50) are given as:

Products		Amount produced	Total value in municipal markets. pesos
Abaca (Manila hemp) . . . . .	kg. (a)	152 766 278	42 767 339
Cacao . . . . .	" (b)	558 357	345 059
Coconuts and coconut products:			
Ripe nuts for food . . . . .	number	63 818 406	2 177 343
Copra . . . . .	kg.	141 764 193	19 016 096
Oil . . . . .	liters (c)	2 688 305	713 288
Tuba (toddy) . . . . .	"	53 938 612	2 524 228
Coffee . . . . .	kg. (b)	752 196	361 754
Corn, shelled . . . . .	liters	496 270 874	14 723 962
Maguey (cantala) . . . . .	kg.	13 389 722	1 747 263
Rice, rough . . . . .	liters	1565 914 802	55 923 821
Sugar and sugar-cane products:			
Crude sugar . . . . .	kg.	350 281 946	31 283 764
Panochas (small cakes) . . . . .	"	23 730 795	2 173 998
Basi (a beverage) . . . . .	liters	6 753 324	500 560
Molasses . . . . .	"	2 216 638	177 812
Tobacco leaf . . . . .	kg.	41 139 174	7 259 169
Total . . . . .			181 695 456 pesos

a) 1 kg. = 2.2 lbs.; b) Estimated; c) Liter = 0.981 dry quarts or 1.0567 liquid quarts.

The area devoted to fruit trees, bananas, and camotes (a variety of sweet potato), ubi (the uvi yam), gabe (= taro) and other vegetables

(1) 1 hectare = 2.471 acres.



is not included, as complete crop statistics for these products are not available.

Abaca (Manila hemp), sugar, copra, and tobacco are the four leading export crops.

The rice crop, which ranks first in point of value, is not sufficient for home needs, and large quantities of this cereal are annually imported into the archipelago, though the Philippine Bureau of Agriculture is endeavouring to extend its cultivation.

Of the area under abaca cultivation in the fiscal year 1916, only 331 876 hectares were harvested, the average yield per hectare being 460 kilos. Albay, Ambos Camarines, and Sorsogon Provinces, in the island of Luzon, and Leyte Province, in Leyte Island, are the leading producing centres, Leyte having the largest average yield.

Occidental Negros is the leading sugar Province, with Pampanga, Batangas, and Iloilo next in order as regards cane area, these four Provinces having, respectively, 29.8 per cent., 16.1 per cent., 8.4 per cent., and 8 per cent., of the total area under cane cultivation in the year ended June 30, 1916. In value of their products Occidental Negros again ranks first, with 40.2 per cent.; Pampanga is second, with 13.1 per cent.; Iloilo is third, with 7.6 per cent., and Batangas fourth, with 5.3 per cent. Cebu and Oriental Negros were the only other Provinces whose output of sugar-cane products in the year under review exceeded 1 000 000 pesos; the former furnished 3.9 per cent. of the total value from 3.6 per cent. of the total area under cane cultivation, the latter 3.2 per cent. of the value from 2.4 per cent. of the land. The value of all sugar-cane products was 34 136 134 pesos, made up of: "Crude sugar" which includes sugar in pilones (bell-shaped earthen shells), sugar in "bayones" (sacks), and bulk sugar; "panochas", which are small cakes of unrefined sugar, ranging from  $\frac{1}{2}$  kg. to one kg. in weight, and are the favourite form of handling sugar for local consumption; "basi", which is a beverage made from the juice of the freshly cut cane stalks, and molasses.

The coconut is already cultivated in many parts of the Philippine Archipelago, but the improvement that is now being effected in the quality of the copra produced in the islands should, in view of the great world demand for oilseeds, produce a further expansion of the industry. Of the 54 153 847 trees reported by the officials who made returns to the Bureau of Agriculture, 299 103 were tuba trees producing 180 litres annually per tree, 24 133 909 were trees too young to bear fruit and 29 720 835 were bearing trees averaging 25 nuts per tree per year.

\* Isabela Province, in the Island of Luzon, is the chief grower of tobacco in the Philippines, having 37.1 per cent. of the total area, producing 38.3 per cent. of the total yield and contributing 44.7 per cent. of the total value of this crop in the year ended June 30, 1916. Cagayan, which ranks second, had only 16.4 per cent. of the area and produced 16.6 per cent. of the total output in that year, but contributed 19.2 per cent. to the total value.

890 - **Value of Poultry for Rural Hygiene.** — PERRONCITO, A., in *L'Economia rurale*, Vol. 59, Part. 16, p. 239. Turin, August 25, 1917.

It has been stated (1) that flies pass their larval stages only in horse manure and not in the mixture of litter and cattle dung. In contradiction to this, however, the writer has constantly observed that the larvae of flies develop in this latter. When litter and cattle dung have been placed on a heap the larvae appear in groups of hundreds or thousands at a time between the layers of the litter in places where it has become damp and converted into manure. Poultry of all ages are fond of turning over manure as it leaves the stable in order to find larvae and remnants of food occurring between the layers of litter; the voracity with which poultry destroy the larvae is a very important factor in rural hygiene.

891 - **The Relation between the Hatching of the Eggs and the Development of the Larvae of *Stegomyia fasciata* (*Aedes calopus*), and the Presence of Bacteria and Yeasts.** — ATKIN, F. E. and BACOT, A. (Of the Lister Institute of Preventive Medicine), in *Parasitology*, Vol. 9, No. 4, pp. 482-536. London, July, 1917.

The clearing action of mosquito larvae in turbid water and their scarcity or absence in clean water, is an old-established popular belief in mosquito-ridden districts of both the old and the new world. Scientific workers have also remarked the relationship existing between the development of bacteria and the growth of the larvae.

The present paper describes a large number of experiments devised by the writers to test the effect of various bacteria and of yeasts upon the hatching of the eggs and the development of the larvae of *Stegomyia fasciata*.

The conclusion of the writers respecting the evidence as a whole is stated as follows: that the larvae of *Stegomyia fasciata* greedily consume both bacteria and yeasts on which they can thrive in the absence of any other food, whereas in very many instances they fail entirely to develop on a variety of nutritive fluids and particles, including dead bacteria, under sterile conditions. In the far less numerous cases where progress was made under apparently sterile conditions, growth was always relatively very slow compared with that under otherwise equivalent but unsterile conditions, and the mortality was very high. The rearing of adults under sterile conditions being so exceptional, the writers feel justified in stating that the presence of bacteria or yeasts is a practical necessity for the maintenance of the species. The ingestion of larger particles and the structure of the jaws are not incompatible with this view, because such particles are likely to be covered with a bacterial growth while the jaws are of use in gnawing away portions of decaying organic matter.

It seems probable that this knowledge may be of assistance in the destruction of this species of mosquito, as it should enable the methods now so largely available for the purification of water from bacteria to be utilized. It may also be of service in enabling Sanitary Officers to escape the annoyance caused by the failure to breed more than one or two isolated species from jars containing mosquito larvae captured by their inspectors. This failure

(1) See B., 1915, No. 1116, and R., 1916, No. 137.

(Ed.).



no doubt arises owing to starvation, because the bacteria are killed by the action of light, it being customary to stand jars with "wrigglers" in the full light of a window. There is the further possibility that the eggs, after a careful and probably lengthy research, might be found to be of service as a rough and ready means of testing the relative purity of water in regard to living organisms.

892 - **Observations on the Influence of Salt and other Agents in Modifying the Larval Development of the Hook-Worms *Ankylostoma duodenale* and *Necator americanus*.** — NICOLL, WILLIAM (*Australian Institute of Tropical Medicine, Townsville, Queensland*). in *Parasitology*, Vol 9, No. 2, pp. 155-189. London, February 1917.

An account of the life-history of hook-worms under normal and abnormal conditions, followed by a description of experiments undertaken with the object of determining the action of common salt and other agents upon the development of hook-worm eggs and larvae in their different stages.

The following are the chief conclusions :

The chief preventive measures are individual cleanliness and thorough and rapid destruction of night soil and deposits of faecal material.

In the presence of a properly organized sanitary system, intelligently utilised, there should be little or no risk of infection. If the indiscriminate deposit of faecal material be not prevented, the matter becomes a problem of considerable difficulty.

The more commonly used disinfectants, if thoroughly employed, would render the faecal matter comparatively innocuous, but their use is not less laborious than the proper removal of faecal matter and its disposal in properly constructed receptacles.

Common table salt has a decidedly injurious effect upon the hook-worm eggs but it requires to be brought into very intimate contact with the infected material. The process of merely sprinkling the surface is almost futile unless the salt be used in enormous quantities.

When mixed with faecal matter, sand promotes the development of hook-worm larvae, but when used as a covering of a certain depth it arrests development.

Exposure to direct sunlight of sufficient intensity kills hook-worm eggs and larvae very rapidly.

893 - **Farming Practice in the Sand Hills Section of Nebraska.** — COWAN, JAMES, in *The University of Nebraska Agricultural Experiment Station, Bulletin No. 156*, pp. 1-68. Lincoln, Neb. 1916.

This bulletin covers the experimentation undertaken during the past five years at the Valentine Substation, established in 1910 for the purpose of aiding settlers and farmers in the Sand Hills district.

The Sand Hills region of Nebraska stretches nearly three hundred miles, extending westward from about 98° west longitude. Its northern boundary is the Niobrara River and its southern boundary the North Platte River. Of the total area of 20 000 square miles, there is not at the present time more than 200 000 acres that is not settled, and there are no whole sections of 640 acres open to homestead entry.



Generally speaking the chief characteristics of the Sand Hills which affect farming are a light sandy soil, small precipitation and extreme variations of temperature. The Sand Hills country is primarily a cattle raising country, but the Kinkaid Act giving 640 acres for a homestead, instead of 160 acres as under the old homestead act, has attracted settlers in large numbers, and many of these are farming in favourable localities with considerable success.

The dry valley bottoms and the better portions of dune sand land are the principal farming lands of the Sand Hills country. Under cultivation, this land needs above everything else preservation of humus or organic matter to enable it to retain moisture and to prevent the blowing of the soil.

No method of improving the range land in the Sand Hills country by the introduction of new grasses has been discovered, but the native herbage rapidly improves if it is not overgrazed and if fires are kept from running over it. The pasturage on the ranges is of good quality. The hay for winter feeding, while not equal in nutritive quality to the range grasses, can be readily and cheaply improved by growing red and alsike clover among it; also winter forage can be greatly improved on the drier farming lands by growing alfalfa. The work done at the Valentine Substation has proved that alfalfa can be grown in most sections of the Sand Hills country, and it is recommended that, where possible, it should be made to take the place of intertilled forage crops, because it would do away with the danger of soil blowing. Experiments have shown that for this section alfalfa exceeds all clovers, including sweet clover, (*Melilotus alba*) in its adaptability to conditions. Sweet clover has been found more adapted to hardpan lands than to Sand Hills lands. Sudan grass has yielded as high as 1667 pounds of hay on light sandy soil, when sown in rows 21 inches apart. Sown broadcast it yielded 1649 lbs. per acre. It is much relished by stock.

None of the other varieties of grain sorghums tested at the Valentine Substation equaled the upright headed dwarf milo in yield. The yield amounted to 11.2 bushels per acre on light soil in 1913, this being the highest recorded yield of three years' investigation. Feterita is a good yielding grain sorghum and stands drought well, but has not fully matured on the lighter upland soils. As a forage crop it is not relished by stock. The maize variety known as Minnesota No. 13 gave heaviest yields, 13.6 bushels per acre under conditions similar to those in which milo gave a yield of 11.2 bushels.

The Irish Cobbler potato has outyielded all other potatoes in tests covering three years. The best depth to plant in light sandy soil is from 4 to 5 inches. The best yields were obtained with rows spaced 42 inches apart and 24 inches in the row. The most profitable size of sets was medium quartered. Potatoes grown on light sandy soil under a mulch of 6 inches of hay yielded 50 per cent. more than when grown in the ordinary way.

Where a sufficient supply of manure is not available, or where owing

to scarcity of moisture the ground is not capable of absorbing or assimilating sufficient manure, a rotation of crops that maintains the humus or organic matter in the soil is desirable.

For tree culture in the Sand Hills country clean cultivation and the preservation of an earth mulch is much more essential than watering. The best quick-growing varieties of trees are Norway poplar, cottonwood and box elder; of the slower growing deciduous trees the American elm and the honey locust have done best. Among trees of the coniferous order, bull pines (*Pinus ponderosa*) have done best.

*Spirea Vanhouttei* has made the best lawn shrub under Sand Hills conditions.

Orchard trees when unsheltered from prevailing winds, or depending on precipitation alone for moisture, are as a rule not successful. Vegetables grow splendidly in the valleys and in sheltered places where they can be irrigated or where there is subirrigation.

In laying down a lawn in the Sand Hills, well-rotted manure should be liberally applied and the seed should be sown early, using a nurse crop of some tender grass which will kill out when frost comes. In watering lawns the same principle as applies to trees is applicable. A lawn should be soaked not sprinkled.

## CROPS AND CULTIVATION.

AGRICULTURAL  
METEOROLOGY

894 - **The Freezing of Fruit Buds ; Researches made in the United States.** — WEST-  
F. L. and EDLEFFSEN, N. E., in *Utah Agricultural College, Experiment Station Bulletin* No. 151,  
pp. 2-24, fig. 1-6. Logan, Utah, February 1917.

When plant tissue freezes, water passes out of the cells and forms ice in the intercellular spaces. If the thawing is done slowly enough, the water gradually passes back into the cells, which again resume their functions, provided the ice has not ruptured the cell wall. If, however, the thawing is done rapidly the cells can only partially reabsorb the water and die from loss of sap.

Low temperatures thus affect the tissues in two ways ; 1) they induce the rupture of the cell wall ; 2) they kill the cells by causing loss of sap.

The degree of resistance to cold varies in the different species in the various periods of their development : 1) according to the degree of the concentration of the cell sap ; the more concentrated the latter, the lower the freezing point ; 2) according to the dimensions of the intercellular spaces which act as true capillary tubes ; in fact, as a result of WALKER's experiments, it was found that liquid in a capillary tube can be cooled far below its freezing point without becoming solid.

There are 3 ways of combating sudden and great falls of temperature :

- 1) By selecting types possessing a high degree of specific resistance.
- 2) By choosing late kinds, in order that the trees may blossom at a time of year when frosts are of rare occurrence, and not severe.



3) By directly combating the cold by means of smoke, a method adopted with excellent results in the United States (California, Colorado, Oregon). Each orchard is furnished with a certain number of receptacles, arranged in the most suitable manner and filled with heavy oils which, on burning, produce a thick cloud of hot smoke that envelops and protects the plants while also preventing any loss of heat by radiation.

The meteorological stations, which are in communication, predict with great exactitude the approach of the cold waves and inform the fruit-growers in time to light the heavy oils in the receptacles at the right moment. This method, though reasonable and practical, is very costly and is naturally only applied in cases where the result is practically certain. Thus, if the minimum temperature predicted is so low that the rise in temperature produced by the smoke would not be sufficient to prevent freezing, it is best not to light the fires. The same advice holds good in the case of a temperature below the temperature limit. It is, therefore, most important to know the critical temperatures for the various stages of the development of the floral buds of the different varieties of fruit trees. The writers carried out a series of very careful experiments, in order to determine these critical temperatures. The apparatus or instruments, used by them were of 3 kinds.

1) *For laboratory tests.* — Three cylindrical concentric vessels, one placed inside the other. In the space between the wall of the first (the largest) and that of the second, is put the freezing mixture (ice and salt); the space between the walls of the second and third cylinders is filled with a salt solution, the temperature of the latter being kept constant by an apparatus provided with two small electric lamps which are lighted and extinguished automatically. In the interior vessel, or vessels, (for there may be 2), the branches of fruit buds are placed.

2) *Apparatus for freezing branches in the orchard.* — This consists of 2 vessels; in the first, which is filled with the freezing mixture, is placed a coil of rubber tubing which is fitted to the opening of the second vessel. Into the latter are introduced the branches of fruit buds; these must be bent, care, however, being taken to avoid breaking them. The second vessel is double-walled, the space between the walls being filled with ice and salt. Through the rubber tube passes a current of air at a given temperature.

3) *Apparatus for freezing the entire tree.* — A double-walled half-cylinder made of galvanised iron and fastened on a wooden base on runners. It is 6 ft. high and 6 ft. in diameter; within the two walls is placed the freezing mixture.

In the experiments, the following factors were taken into consideration: 1) The kind of floral buds; 2) their state of development; 3) the duration of the freezing; 4) the rate of thaw; 5) the humidity; 6) the minimum temperature (marked by BEKMANN's thermometer). The injury done by the low temperatures is expressed by the percentage of buds killed.

Table I gives the results obtained with Elberta peach buds (laboratory experiments).



TABLE I. — *Results obtained with Elberta Variety of Peach*

No.	Date	No. of buds	Duration	Development	Temperature		% Damage
					Degrees F.	Degrees C.	
1		35	30 minutes	In bud	20.0	— 6.66	66
2		38	20 "	Full bloom	24.0	— 4.44	63
3		22	50 "	" "	24.0	— 4.44	64
4		42	5 "	" "	25.0	— 3.87	58
5		62	15 "	" "	25.0	— 3.87	28
6		35	10 "	" "	25.0	— 3.87	72
7		42	40 "	" "	26.0	— 3.33	40
8		37	40 "	" "	27.0	— 2.77	0
9		27	20 "	" "	27.5	— 2.50	0
10	25 April	80	10 "	Fruit setting	24.5	— 4.11	30
11	26 "	16	10 "	" "	26.0	— 3.33	75
12	25 "	70	10 "	" "	26.5	— 3.05	48
13	26 "	49	10 "	" "	27.0	— 2.77	75
14	26 "	78	20 "	" "	27.5	— 2.50	56

Many experiments have been made with the Jonathan variety of apple and with Double Nattie cherries. The following are the most important results obtained :

1) There is a range of at least 5° F. (2.77° C.) between the temperature at which only about 5 per cent. of the buds are damaged, and the temperature that will kill all of them.

2) In the case of Double Nattie cherries, when the fruit is setting 29° F. (— 1.66° C.) caused no damage and 24° F. (— 4.05° C.) killed practically all of them.

3) With Jonathan apple blossoms in full bloom, 28.5° F. (— 1.94° C.) caused no damage and 24° F. (— 4.44° C.) killed about half of them.

4) The results obtained in the case of the prune tree are set forth in Table II.

TABLE II. — *Test of Hardiness of Prune Buds to Frost.*

No.	Date	No. of buds	Duration	Development	Temperature		% Damage
					Degrees F.	Degrees C.	
1	25 April	142	12 hours	Full Bloom	21.0	— 6.10	100
2	25 "	101	15 minutes	" "	24.5	— 4.11	52
3	25 "	160	15 "	" "	27.0	— 2.77	47
4	26 "	67	15 "	" "	28.5	— 1.94	37
5	9 May	30	25 "	Fruit setting	25.5	— 3.61	92
6	9 "	30	25 "	" "	27.5	— 2.50	47

5) The susceptibility of floral buds varies during the course of their development, and reaches its maximum values during fruit-setting. The temperatures which will kill about 50 per cent of the Elberta peach buds are as follows: 14° F. (— 10° C.), when they are slightly swollen; 18° F. (— 7.77° C.) when well swollen; 24° F. (— 4.44° C.) when they are showing pink; 25° F. (— 3.87° C.) when in full bloom; 28° F. (— 2.22° C.) when the fruit is setting.

895 — **The Resistance of Certain Ornamental Plants to Frosts, in England.** — See No. 909 of this *Review*.

896 — **Measurement of the Inactive or Unfree Moisture in the Soil by Means of the Dilatometer Method.** — BOUYOUCOZ, G. J., in *Journal of Agricultural Research*, Vol. VIII, No. 6, pp. 195-217 + 1 fig. Washington, D. C., February 1917.

SOIL PHYSICS,  
CHEMISTRY  
AND  
MICROBIOLOGY.

It is possible to determine with the help of a dilatometer, the amount of water in a soil which does not freeze when it is kept at — 3° C. Different types of soil were tested, from a quartz sand to a black heavy clay. Each sample was prepared by adding 5 cc. of distilled water to 25 gm. of air-dried soil. After the soil was placed in the bulb of the dilatometer, the bulb was completely filled with the ligroin, freed from all air, and then placed in a cooling mixture the temperature of which was maintained at — 4° C. When the contents had attained the temperature of — 3° C, the dilatometer was moved gently in the cooling mixture until solidification commenced, and the expansion was measured when equilibrium was reached. It was thus found that the amount of added water that failed to freeze varied from 2 per cent. in the case of quartz sand, to 80 per cent, in that of heavy clay and that, as a rule, the more colloidal the soil, the smaller the amount of water that froze.

The values obtained by the method in question correspond remarkably closely to the moisture content, known as the wilting coefficient; to the percentage of moisture at which solidification cannot be started; to the thermic critical moisture content, etc. (1). This water which fails to freeze is designated as unfree or inactive water. Many evidences indicate, however, that a large portion of it may exist as physically adsorbed or chemically combined in a more or less unstable manner. Any how, this inactive water is not in an absolutely unchangeable condition, but can be converted into free, or available water, by various factors or treatments: thus in colloidal soils, the free water decreases with the increase in supercooling, the same effect is produced by increasing the moisture content of the soil, and also by successive freezings.

The writer is continuing his investigations on the subject. Appended to the article is a bibliographical list of 9 works.

897 — **The Transposition of Sesquioxides in Forest Soils, Especially in View of the Formation of Alios (Ortstein) and of Laterite.** — STREME, H., in *Kolloid Zeitschrift*, Vol. XX, Part 4, pp. 161-168. Dresden, 1917.

The writer examines the theory of the formation of ferric oxide and of alumina in the soil, according to which this formation would result from the

(1) See also *R.*, 1916, No. 8.

(Ed.).



coagulation of the corresponding "sols", that is to say, from their colloidal solutions. He studies their relations with the physico-chemical composition of soils and with the physiographical environment, vegetation and climate for the temperate and tropical zones.

He notes, first of all, that the composition of the soil solution is one of the principal factors in the process of coagulation, especially as regards the content of organic substances. The course of the phenomenon is the same for the forest soils of the temperate zones as for those of tropical regions, whether one is concerned with the formation of alios (Ortstein) or with that of laterite and of "red soil": the "sols" viz. the colloidal solutions of their humus, alumina and iron oxides are carried off into the subsoil, where they are precipitated and eventually decompose. The intensity of the phenomenon depends partly upon the activity of such agents as water, humus, atmosphere, heat and also the colour of the soil, i. e. the phenomenon is more intense when the soil is dark red instead of being yellowish red or yellowish brown.

898 - **Some Observations on the Occurrence of Infertility under Trees in India.** — JATINDRA NATH SEN (*Agricultural Chemist*), in *The Agricultural Journal of India*, Vol. XII, Part III, pp. 390-405. plates XXXIII-XXXVII, tables 8. Calcutta, July, 1917.

It is well known that trees often give rise to the formation of infertile patches round themselves. The theory of shade which is usually adduced does not wholly explain the phenomenon. In the first place the affected tract of land does not always coincide with the shade-limit and secondly, lands under bamboos are known to remain infertile even after the removal of the clumps — the source of obstruction of the sun's rays.

Pot experiments with plants grown in soil taken from under a tamarind tree showed that the "tamarind soil" contained something which was evidently positively harmful to plant growth. In this case, the trouble was found to be due to the accumulation of an excessive amount of soluble salts, but this is not invariably so. The nature of the salts is also of importance, some salts being more toxic than others.

This accumulation of soluble salts might be due partly to the leaching out of the mineral matter in the dead remains of the plant (decayed roots and fallen leaves) but transpiration of the plant is likely to be an important factor. A growing tree transpires an enormous amount of water. The roots have to abstract this water from the soil particles with which they come in contact. On account of the soil near about the roots thus getting drier than the rest of the mass of soil, there sets up a movement of water from the wetter to the drier zone to restore the equilibrium. This movement goes on continuously with the growth of the tree. Along with the water, the dissolved salts present in the soil solution also move towards the tree.

On this assumption, plants having a high transpiration ratio would produce harmful results quickly. It may be that plants having thin or small leaves — tamarind, "pipal" (*Ficus religiosa*) — transpire relatively more water than trees having thick leaves — "bar" (*Ficus bengalensis*). The extent and the distribution of the root-system are also of importance. Plants having a smaller root-range relatively to the transpiration would.



of course, effect a greater local concentration of salts. Again, the injurious effect may be apparent soon if the roots are mostly in the top layers of soil.

These considerations might probably hold in the case of bamboos. Other factors are competition for sunlight and plant food and inability to get rid of some of the injurious products of the vital activities of the plant (including carbonic acid) sufficiently rapidly.

With regard to remedies in such cases of infertility, the removal of the tree is the first step. After this, attempts should be made to effect a permanent improvement in the texture of the soil by means of deep cultivation and the addition of organic manures. Proper drainage facilities should be provided so that the salts may readily pass out of the soil. In some cases it may be necessary to have recourse to an efficient system of irrigation (combined with suitable drainage) to get rid of the accumulated salts.

899 - **Investigations in Cost and Methods of Clearing Land.** — THOMPSON, M. J., in *The University of Minnesota Agricultural Experiment Station Bulletin* No. 163, pp. 1-32. University Farm, St Paul, Minnesota, September 1916.

OPENING-UP  
LAND FOR  
CULTIVATION

Results of investigations, relating to cost and methods of preparing cut-over timber lands for farming purposes, carried out at the Minnesota Northeast Demonstration Farm and Experiment Station, near Duluth.

Fifteen acres of cut-over timber land were divided into three tracts of five acres each. On tract I the clearing was forced with dynamite; on tract II the stumps were first split with small charges of dynamite and then pulled with a machine; tract III after being brushed out was seeded to clover and timothy pasture, and cleaning with dynamite was postponed five years until 1918.

The conclusions thus far arrived at may be stated as follows:

1. Cost (I) and method are determined largely by the character of the soil and the kind of vegetation.

2. The returns in forest products (\$ 43.53 per acre) covered practically the cost of brushing and other cleaning work (\$ 46.53 per acre) up to the stumping stage.

3. The cost per stump for blasting (\$ 0.06 per stump) and pulling (\$ 0.04 per stump) on tract II was almost identical with the cost of explosives alone (\$ 0.11) on tract I.

4. The cost of clearing was much less on tract I (\$ 0.04 per stump), since much less labour was required in piling and burning the stumps (\$ 0.10 per stump on tract II).

5. The cost per stump for removal was least for the man-power machine (\$ 0.09), slightly greater for the horse power machine (\$ 0.12) and greatest for dynamite (\$ 0.14) (This was for green timber and did not include the cost of piling which makes the use of dynamite the cheapest method by a good margin).

(1) Price of man labour 20 cents per hour and of horse labour 7 1/2 cents per hour (horses work practically the entire year thus reducing the cost per hour).

6. Some relation may apparently be established between the size of the stump and the size of the charge required to remove it.

7. The man-power puller will work to best advantage on the small farm, where the farmer has very limited means.

8. Under average farm conditions dynamite is usually to be preferred to the stump puller either alone or in combination. However, the plan of clearing being followed on tract III will not only be carried out at a lower cost as predicted, but is actually giving a larger net return in pasture the first year than has been realized from the first crops from land on which the clearing has been forced. This is because forced clearing requires more labour and because land cleared by this method is relatively lacking in humus which curtails yields.

9. Following the removal of stumps from cut-over timber lands, on account of the shallow covering of vegetable matter, care should be taken to plough shallow the first time and to take immediate steps to increase the humus by seeding the land to clover and grasses, using barley or oats for a nurse crop.

The work from which these deductions were made was done on land which averaged more than two hundred stumps to the acre. These had a diameter of about 12 inches at the base and 10 inches at the cut-off.

Sixty per cent of the timber was green. The lower grades of dynamite were used on all kinds of stumps except green birch.

Analytical data presented include :

Cost of clearing expressed in units of time and in units of exchange.  
— Detailed study of the various stages of the clearing work. — Forest products, a credit in cost of clearing work. -- Relative cost and efficiency of dynamite alone and in combination with a puller. — Individual stump studies. — Standardization of charge, based on size, kind, condition, and location of stump. — Comparative study of dynamites of various strengths. — Special study of the man-power puller. — Land clearing practice. — Farm development.

900 - **The Divining Rod.** — VAN GULIK, D., in *Mededeelingen van de Ryks Hoogeer Land-Tuinen Boschbouwschool*, Vol. XII, No. 3, pp. 131-167, 1 plan. Wageningen, 1917.

The Society of Natural Sciences of Wageningen, Holland, organised experiments in order to test the value of the divining rod. Four diviners took part in the tests which consisted : 1) of tracing underground streams and controlling their courses in a given plot ; 2) of determining whether underground conduits were full of water or dry. The results showed that, in many cases it was probable, and in some cases certain, that the rod did react to some apparently existent conditions. This shows the apparent success of diviners to be due to superficial control, and their observation and experience of the ground.

Completely unfavourable results were obtained in searching for pre-determined water-currents ; correct answers were obtained in 23 cases, and wrong ones in 25. The results of the experiments were, therefore, in opposition to the claims of diviners.

This conclusion agrees in every way with that of Prof. WEBER on the practices of German water-diviners.

901 - **Dry Farming Investigations at the Sherman County Branch Experiment Station.** — STEPHENS, D. E. and HILL, C. E., in *Oregon Agricultural College Experiment Station, Bulletin* 144, pp. 47, 30 tables, 13 figs. Moro, Oregon, April 1917.

METHODS  
OF SOIL  
CULTIVATION

Besides the experiments with spring cereals carried out at Moro (1), further experiments with winter cereals and other cultivated plants were made there and continued from 1911 to 1916 inclusive. The meteorological observations given in this bulletin cover the period from 1911 to 1916.

The experiments included: 1) varietal tests; 2) selection; 3) crop rotation; 4) methods of soil cultivation.

*Winter Wheat.* — 44 varieties were tested. Those belonging to the group of the Turkey and Crimean varieties gave the highest yields. These are the varieties chiefly grown in the west of the United States where winter wheat does well. They have a high milling value, and amongst them are found the wheats most resistant to cold. They are also very resistant to drought and are found in all the districts where dry-farming is practised; where there is a heavy rainfall Turkey wheats are not grown.

In experiments carried out over 4 years the average yields of the Argentine (32 bushels per acre), Kharkov (31.2 bushels per acre), Alberta Red and Armavir (31 bushels per acre) varieties, exceeded the local Turkey varieties by from 15 to 18 %.

The experiments show the best time for sowing winter wheat to be between the 10th. and 25th. October. An average of from 45 to 55 lbs. of seed per acre was used. In dry soil, or where sowing is late in the autumn, these quantities must be increased.

*Barley: Winter Barley.* — This is not so resistant to cold as winter wheat. Many varieties were tested, but only 5 were retained. These are given below, together with the average yields obtained:

No.	Variety	Yield per acre (bushels)
1	Texas winter	49.0
2	Maryland winter	45.0
3	Tennessee winter	42.1
4	Chevalier	39.9
5	Utah winter	36.8

In 1916 a new variety, Trebe (936), was tested as a spring barley, and gave a yield of 95.8 bushels per acre.

The results of the experiments with different varieties of spring wheat, spring barley, oats, spelt and emmer described, have been published in the *U. S. Department of Agriculture, Bulletin* No. 498, and the 1916 results do not differ from those previously obtained.

*Field Peas.* — The Lima, White Canada, O' Rourke, Solo and Carleton varieties gave the highest yields. The average for 4 years is 22 bushels

(1) See R. June, 1917, No. 540.

(Ed.)



per acre. Grown in the same field during 4 consecutive years, the yield was 18.8 bushels per acre.

The yield of spring wheat following on field peas was about equal to that obtained when wheat is grown on fallow land.

*Maize.* — The best results were obtained with Walla Walla White Dent, Min. No. 13, Northwestern Dent and Brown County Yellow Dent varieties.

*Potatoes.* — The highest yields were obtained with the Green Mountain, Pearls and Early Rose varieties.

A great many cultivation methods were tried for growing wheat under the summer-fallow-system. The results obtained so far prove that :

1) Autumn disking, if the stubble is heavy, is not profitable.  
2) If ploughing is done early, spring disking is of doubtful value if the stubble is short.

3) Spring disking increases the yield of winter wheat if ploughing is deferred in the spring.

4) A farmer loses from 1 to 2 bushels of wheat per acre every week his ground is left unploughed after April 1, if the ground has not been well disked and all plant growth destroyed.

5) Ground ploughed in autumn with a mouldboard plough will give slightly higher yields than ground ploughed in autumn with a disk plough.

6) Early autumn ploughing, when the ground is dry, will give as high yields as late autumn ploughing when the ground is wet.

7) Deep ploughing (8 to 9 inches) will not give higher yields of spring wheat after summer fallow, than shallow ploughing (4 to 5 inches)<sup>1</sup>

8) Yellow berries (grain rich in starch) in Turkey wheat are more prevalent on ground ploughed late, without being disked before ploughing, than on ground ploughed early in spring. This discovery is of great importance.

9) Subsurface or surface packers do not increase the yield of either winter or spring wheat after summer fallow.

10) Allowing weeds to grow in the summer fallow reduces the wheat yields.

11) Harrowing winter wheat in the spring is of no benefit unless it destroys weeds. With normal wheat stands, no increase in yields has been obtained when winter wheat has been harrowed in the spring.

In the rotation experiments the highest yields of spring wheat were obtained after a summer fallow. The yields of spring wheat, following on field peas and potatoes, were nearly as high as those obtained after summer fallow. Following maize, spring disked, the yields of spring wheat were 4.6 bushels per acre less than following summer fallow.

No important increase was obtained in the yields of a crop of small grain or maize when the previous crop had been turned under for green manure.

The yields of spring wheat, oats, barley and maize, in 1916, on ground which grew alfalfa for 2 years and was left fallow for 1 year, were not so high as on ground which had been alternately cropped to grain and left fallow.

Cooperative trials were made by farmers with seed obtained from the

Branch Station. These showed that the highest yielding varieties at the Branch Station, when grown by farmers, will give equally favourable results over a large dry-farming area.

902 - **Wheat Cultivation by Hoeing.** — See No. 914 of this Review.

903 - ***Crotalaria usaramoensis* as Green Manure in Java.** — VAN HELTEN, W. M., in *Mededeelingen uit den Cultuurtuin*, No. 6, 1 fig. Buitenzorg, 1917.

This plant has already been mentioned by the writer in *Mededeelingen uit den Cultuurtuin* 1915, No. 2, under the name of *Crotalaria Muyussi* (1), having been received under this title from Amani. BACKER, however, has now classified it as *C. usaramoensis*.

On land of the Buitenzorg (Java) experimental Garden, where other plants usually employed for green manure: *Vigna sinensis*, *Centrosema Plumieri* and other species of *Crotalaria*, had only given mediocre results, *C. usaramoensis*, on the other hand, was surprisingly successful. Sowing was done on April 5, 1916; at the end of 3 months, as the soil was again completely covered with weeds, it was given a couple of hoeings. The 1st. cut was made on September 20, when the first flowers had begun to appear. A 2nd. cut was made on November 10 and a 3rd. on December 15; this latter was weighed and found to give a crop of nearly 2 tons of green leaves per acre. When left uncut *Crotalaria usaramoensis* may reach a height of 5 feet.

Comparing this plant with others used for green manuring, the writer enumerates the following advantages: 1) the stems remain supple, do not lignify, and rapidly decompose; 2) it produces a greater quantity of green leaves than the plants usually employed; 3) it is more easily adaptable to a poor soil; 4) the young plants are more resistant to rain; 5) it is superior to other species of *Crotalaria* in its resistance to insect attack.

*C. usaramoensis* is also a profitable forage plant and the writer recommends experiments from this point of view.

904 - **Measures Adopted in England Respecting the Supplies and Prices of Basic Slag.** — *The Journal of the Board of Agriculture*, Vol. XXIV, No. 5, pp. 580-582. London, August 1915.

According to this notice issued by the Food Production Department respecting the supplies of basic slag and its price for the season 1917-1918, the slags which are now available in England for grinding have a lower phosphatic content, so that the supply of high grade slag is much less than was formerly the case. All the suitable slag available is being ground, and the total tonnage is fully equal to what it was before the war. As no export is now allowed, the quantity available for home consumption is in fact much larger, though it is still below the demand. Arrangements are being made in certain cases to grind a low-grade slag, which has not hitherto been used as a manure; it can be economically used on land within a moderate distance of the works.

MANURES  
AND MANURING

(1) See R., 1916, No. 148.

(Ed.).



The Food Production Department, in conjunction with the Ministry of Munitions, has come to an arrangement with makers in regard to the maximum prices to be charged for the slag, which vary according to the different works. Thus for some slags, the prices per ton for lots of not less than 4 tons, free on rail at works, in makers' single 2 cwt. bags, net cash, were fixed within the following limits: basic slag, citric soluble 16 % per cent. 44s., basic slag, citric soluble, 34 per cent., 72s. The slags made by other firms varied in price from 46s. for slags with 17-20 per cent. total phosphates, to 80s. for those with 42 per cent. (1).

905 - **The Nature of Cement Mill Potash.** — NESIELL, R. J. and ANDERSON, E., in *The Journal of Industrial and Engineering Chemistry*, Vol. IX, No. 7, pp. 646-651 + 1 fig. Easton, Pa., July 1917 (2).

Up to a comparatively short time ago, the escaping dust and fumes from cement mills, amounting in some cases to 10 tons or more per kiln per day, only constituted a serious problem as a nuisance to be abated in populous districts.

As, on account of the war, the export of potassium salts from Germany to the United States had ceased, methods were devised in the latter country for using these waste products as a source of potash. Among these methods may be mentioned; the use of simple settling chambers of large capacity, bag houses, water sprays and electrical precipitation. The latter, however, is the only one that has received any extended application. The electrical precipitators were originally installed for the purpose of removing the cause of complaint and litigation on account of the damage caused by the dust and fumes, but with the increasing value of crude potash salts, due to the war, the possibility and practicability of utilising this large amount of cement dust were soon recognised.

The dust collected from cement kiln gases consists of partly calcined raw material and ash from the fuel which have been mechanically carried over by the draught, and also of volatised alkali compounds; the latter are principally in the form of sulphates. They contain, as a rule, about 10 or 11 per cent. of potash; of this approximately 86 per cent. is water-soluble, so the dust with the present average value of \$3.50 per unit of soluble potash per ton, is worth about \$27.00 per ton. The soluble potash present usually occurs as sulphate, due to a combination of this base with the sulphur of the fuel, and where there is a deficiency of sulphur, it occurs as carbonate.

The rest consists of so-called insoluble potash; this is however "slowly soluble", that is to say, it is soluble in dilute hydrochloric acid, or after prolonged treatment with boiling water, and is probably of a silicious nature, being largely formed by the union of potash vapour with incandescent gas particles. The solution of this potash is accelerated by the presence of lime. The slowly soluble potash compounds are also formed by the

(1) See R., July 1916, No. 736.

(2) See the correction made on p. 814 of No 8. (August 1917) of the same journal.

(Ed.).



interaction of potash salts in solution with silicious material, this recombination being greatly accelerated by heat.

The action of moist soil promotes the availability of the slowly soluble potash. In view of the gradual and continued solution of the potash in cement kiln dust, it should be of particular value as a fertiliser.

Two series of facts, however, are worthy of notice :

1) Whether the fuel used is oil or coal. In the latter case, the amount of water-soluble potash is less.

2) The lighter fractions of the dust which contain the greater percentage of volatilised compounds are richest in soluble potash, they contain, for example, 28.96 per cent. of potash with the oil-fired kiln, and 20.60 per cent. with the coal-fired kiln.

906 - **Studies on the Root Nodules of Non-Leguminous Plants in Japan.** — SHIBATA, KEITA and TAHARA MASATO, in *The Botanical Magazine*, Vol. XXXI, No. 366, pp. 157-182, 16 fig. + 1 plate. Tokyo, June 1917.

The formation of root nodules in non-leguminous plants has excited much interest, for it appears that also these nodules are capable of assimilating free nitrogen. All the nodules in question have certain common external characters (of these the most noticeable is their dichotomous ramification), but the distinctive character of the species which bears them is clearly seen in the anatomical structure of the nodules

Many points are still a matter of controversy, especially the systematic position of the endophyte giving rise to these structures. In order to throw some light upon the subject, the writers undertook a comparative histological study of the principal types of root nodules occurring in non-leguminous plants, namely 1) *Coriaria*; 2) *Myrica*, *Gale* and *Casuarina*; 3) *Alnus* and *Elaeagnus*.

The results were as follows :

Type 1: *Coriaria*. — Abundant symbiotic tissue, clearly marked off from the cortical parenchyma; the endophyte is here a typical actinomycete. The colonies in the host-cells have continuous walls, with centripetal, club-shaped filaments arranged like a comb around the vacuole containing the cell sap.

Type 2: *Myrica*. — The endophyte, an actinomycete, takes up its position in a peripheral layer of the cortical parenchyma, this layer being from 1 to 3 cells thick. In the centre of each host-cell is found a large dense coiled mass of the endophyte with club-shaped filaments radiating in all directions.

Type 3: *Gale*. — The cells containing the endophyte are irregularly distributed throughout the cortical parenchyma. No definite radial arrangement of the filaments is noticeable. Conidia formed by segmentation. It is probable that the root nodules of *Casuarina* also belong to this group.

Type 4: *Alnus*, *Elaeagnus* and *Ceanothus*. — Symbiotic cells distributed throughout the cortical parenchyma. Formation of little pustules at the periphery of the thick coiled masses of the endophytic filaments.

The root nodules of *Coriaria* are superior, therefore, to all the others as regards their anatomical differentiation.

Their characteristic symbiotic tissue is, from the point of view of its organisation, quite equivalent to the bacteroid tissue of the root nodules of leguminous plants.

The symbiotic endophytes of the root nodules studied by the writers, have important morphological characters in common. They are always formed of thick coils of very delicate, much-ramified mycelial filaments which stain best with acid fuchsin, and often enclose granules staining with Gram's reagent; in other respects, they show no cytological differentiation. The writers consider as typical the endophytes of *Myrica* and *Coriaria* in which the actinomycete characters are unmistakably manifested. All the others can easily be included among the actinomycetes, according to the present definition of that group. Whether there may be any phylogenetic relationship between the groups of plants furnished with root nodules is still an open question, as far as the genus *Alnus*, the Myricaceae and the Casuarinaceae are concerned.

In the case of the Coriaceae, the data necessary to decide the matter are still wanting. The family of the Elaeagnaceae seems to have quite different connections. That the genus *Alnus* can assimilate free nitrogen seems very probable. As regards the other plants furnished with root nodules, the question can only be settled by means of careful experimental work. The opinion often expressed by HILTNER and others, that the soluble assimilation products of the symbiots of the Leguminosae and *Alnus* leave the hostplant, needs direct proof. It is only possible to determine by the aid of the microscope that the living substance of the endophyte is certainly digested and re-absorbed.

It is much to be hoped that further biochemical studies will succeed in explaining many important points connected with the material symbiotic exchange.

907 - **The After-Ripening of Sugar-cane; Chemical Changes which take place after Cutting.** — BARNES, J. H. (Agricultural Chemist, Punjab Agricultural College, Lyallpur), in *The Agricultural Journal of India*, Vol. XII, Part II, pp. 200-215, tables X. Calcutta, April 1917.

The writer's researches aim at establishing the chemical changes which take place in the sugar-cane after cutting, under the climatic conditions of Northern India, and at determining the factors underlying local practice with regard to the treatment of cut cane.

The writer summarises his results as follows:

It is evident that there is a scientific foundation for the custom practised in the Gurdaspur district of storing cut cane before crushing, as this tends to further ripening.

From the data recorded in the paper it is clear that this is attended with danger of losing sugar if the storing is continued for too long a period.

The length of time for which cane can be stored without suffering loss of sugar, and during which an actual increase in the amount of sugar in the juice will take place, will vary with the temperature of the air and the condition of the cane. This period will become shorter as the temperature rises. Excessive cold, on the other hand, including too great a change in



temperature, may also bring about losses in sucrose owing to suspended activity of the cell protoplasm and result in a loss of control of the ordinary fermentation changes normally taking place there.

The Java system of covering cut cane with damp trash is to keep the cane stem alive. By this treatment the cane will be maintained at a uniform temperature and being in a moist atmosphere will not lose water. For a limited time, depending on the temperature and condition of the cane, there should be an increase rather than a decrease in the sucrose content of the cane. On the other hand, moist heat will only induce the growth of moulds, fungi, and bacteria, all of which bring about decay and fermentation changes, but will, once the cell is dead, induce rapid decay in the cell contents by hydrolysis and oxidation.

The after-ripening of cane is a matter of some importance to the factory owner who may, at any time, be forced to store cut cane owing to a breakdown in the mill, and the chemical changes outlined above will probably be of interest to him as well as to the student of the chemistry of sugar.

908 - **Studies on Tobacco Seeds, in Java.** - JENSEN, HJ., in *Proefstation voor Vorstenlandsche Tabak*, Mededeeling No. XXVIII, pp. 51-87 + 3 fig. Semarang, 1917.

The author summarises the results of his studies on tobacco seeds as follows:

- 1) The small quantity of reserve food contained in the tobacco seed makes it necessary for the young plant to provide early for itself; for this reason, the first few days following germination are the most critical for tobacco.
- 2) From 15 to 20 grm. of seed may be collected from each plant.
- 3) Seed-capsules smaller than 17.5 mm. are of no value.
- 4) By removing some of the seed-vessels from a plant, the number of the seeds is greatly diminished without improving their quality.
- 5) The leaves may be removed from a plant without danger as soon as the first seed-capsules begin to ripen.
- 6) The germinating capacity of seeds collected when they begin to mature is greater than that of half-ripe seeds.

This fact may be explained thus: The reserves of completely ripe tobacco seeds are composed of oils rendered assimilable by the ferments of the germ (lipase and others). At the beginning of maturation the oils are not yet formed, the reserve material is still directly assimilable by the embryo, and germination may take place. When the seed is about half ripe the oils begin to form, but it is only when the seed is completely ripe that the ferments form in sufficient quantity. It follows that the germ of half-ripe seeds cannot assimilate nutriment and germination does not occur. On the other hand, in certain cases, the germinating capacity has been improved by drying half-ripe seeds; in other cases, drying unripe seeds (i. e. seeds collected at the beginning of ripening) or half-ripe seeds, has been detrimental.

For this reason preference should be given to seeds which are as ripe as possible.



7) The seeds may be sorted with a sieve or a blower; the second method gives the best results.

8) The seeds may be kept in tin boxes with lime without there being any danger of their germinating.

909—**Effect of Frost on Plants at Leonardslee, Horsham, Sussex, England.** — LODER, E. G., in *The Gardeners' Chronicle*, Vol. LXII, No. 1598, p. 57. London, August, 1917.

Leonardslee is 270 feet above the sea, which is thirteen miles away.

The soil varies considerably, generally, however, containing sand more or less mixed with clay. Geologically it is "Upper Tunbridge sand" and "Cuckfield clay".

The natural growth is heather, bracken and birch trees.

Frost began on November 16, 1916. There was frost every night during the following 94 days, except on nine occasions (85 frosts in 94 days) to February 17. In April there were snowstorms nearly every day until the 17th. The thermometer fell to 9°F. on the grass on February 10, 1917, and to 17°F. in the screen — 23° of frost. For some days during the winter there was a cutting, north-east wind, and it is thought that most of the damage to the plants was caused by the wind, and not so much by the cold.

#### KILLED.

<i>Clanthus puniceus</i> (*)	<i>Escallonia organensis</i>	<i>P. pseudo-strobus</i>
<i>Pistacia atlantica</i> (*)	<i>Eucalyptus amygdalina</i>	<i>P. Bonapartea</i> (°) (1)
<i>Podocarpus ferruginea</i>	<i>E. Beauchampiana</i>	<i>P. Montezumae</i> (type)
<i>P. latifolia</i>	<i>E. cordata</i>	<i>Phyllocladus trichomanoides</i> (°)
<i>Gordonia obliqua</i>	<i>Callitris robusta</i> (*)	<i>Arctostaphylos stanfordiana</i>
<i>Olearia semidentata</i> (°)	<i>Lindera glauca</i>	<i>Rhododendron bullatum</i>
<i>Zanthoxylum acanthopodium</i>	<i>Pinus longifolia</i>	<i>R. Fordii</i> (°)
<i>Heteromeles arbutifolia</i>	<i>P. canariensis</i>	

\* On a wall. — (°) Also in another list.

#### SEVERELY INJURED OR CUT TO THE GROUND.

<i>Eucalyptus Globulus</i>	<i>Cupressus lusitanica</i> var.	<i>Lindera megaphylla</i>
<i>E. acerovula</i> (2)	<i>Benthamii</i> (°)	<i>Euonymus fimbriatus</i> (°)
<i>E. Muelleri</i> (3)	<i>Juniperus pachyphloea</i>	<i>Pistacia lentiscus</i>
<i>E. viminalis</i>	<i>Widdringtonia Whyter</i> (*)	<i>Carpenteria californica</i>
<i>Clethra arborea</i>	<i>Podocarpus acutifolia</i>	<i>Escallonia macrantha</i>
<i>Ulex europaeus</i>	<i>P. dactyloides</i>	<i>Olearia argophylla</i> (*)
<i>Calluna vulgaris</i>	<i>P. macrophylla</i> (°)	<i>Vaccinium Myrsinites</i>
<i>Pinus halepensis</i>	<i>Rhaphithamnus cyanocarpus</i>	<i>Banksia paludosa</i> (*)
<i>P. patula</i>	<i>Coprosma lucida</i>	<i>Cassinia leptophylla</i> (*)
<i>P. Greggii</i> (°)	<i>Aristolelia tomentosa</i>	<i>Pentapterygium serpens</i>
<i>P. Bonapartea</i> (°)	<i>Azara crassifolia</i>	<i>Bumelia lycioides</i>

(1) *Pinus Bonapartea* is considered identical with *P. Ayacahuite* by some botanists; this latter, however, is a much hardier plant and not a leaf has been browned (Author).

(2) The *Index Kewensis* considers this species identical with *Eucalyptus Stuartiana*. — *E. macrorhyncha* — *E. piperita*.

(3) The *Index Kewensis* considers this species identical with *E. incrassata*.

<i>Gordonia anomala</i> (*)	<i>Arctostaphylos Uva-ursi</i> var.	<i>D. aromatica</i> (°)
<i>Pseudopanax ferox</i>	<i>californica</i>	<i>Berberis congestiflora</i> var. ha-
<i>Dendromecon rigidum</i> (*)	<i>A. media</i>	keoides
<i>Feijoa Sellowiana</i> (*)	<i>A. manzanita</i>	<i>B. Fortunei</i>
<i>Peumus Boldus</i>	<i>Osteomeles anthyllidifolia</i>	<i>Fagus</i> ( <i>Nothofagus</i> ) <i>Cunning-</i>
<i>Colletia cruciata</i>	<i>Myrtus Luma</i>	hami (°)
<i>Quercus suber</i>	<i>Camellia Thea</i>	<i>F. Solandri</i>
<i>Q. densiflora</i>	<i>Olea europaea</i> (°)	<i>F. Menziesii</i>
<i>Q. nigra</i> (aquatica)	<i>Tricuspidaria lanceolata</i>	<i>Rhododendron linarifolium</i> .
<i>Ceralonia siliqua</i>	<i>T. dependens</i>	<i>Embothrium coccineum</i> (°)
<i>Mitraria coccinea</i>	<i>Drymis Winteri</i>	<i>Lithospermum prostratum</i> (°)

\* On a wall — (°) Also in another list.

### VERY SLIGHTLY INJURED OR LEAVES BROWNED.

<i>Berberidopsis corallina</i>	<i>C. funebris</i> (°)	<i>Crevillea juniperina</i>
<i>Berberis pruinosa</i>	<i>C. cashmeriana</i>	<i>C. rosmarinifolia</i>
<i>B. Nepalensis</i>	<i>C. lusitanica</i> var. <i>Bentharii</i>	<i>Pittosporum tenuifolium</i> (30
<i>Laurus camphora</i> (*)	<i>C. torulosa</i> (°)	feet)
<i>Notelaea excelsa</i>	<i>Podocarpus macrophylla</i> (°)	<i>P. patulum</i> (*)
<i>Cinnamomum Loureirii</i> (*)	<i>Juniperus procera</i> (°)	<i>P. rigidum</i> (*)
<i>Azara microphylla</i>	<i>Myrtus communis</i>	<i>P. Ralpii</i>
<i>Fobiana intricata</i>	<i>Callistemon linearis</i>	<i>P. pauciflorum</i>
<i>Grevinia Abelliana</i> (*)	<i>C. salignum</i>	<i>Fagus</i> ( <i>Nothofagus</i> ) <i>Cunning-</i>
<i>Erica arborea</i> (°)	<i>C. coccineum</i>	hami (°)
<i>E. mediterranea</i> (°)	<i>Leucothoe Davisiae</i>	<i>F. fusca</i>
<i>Itea virginica</i>	<i>Rhododendron Delavayi</i>	<i>F. cliffortioides</i>
<i>I. ilicifolia</i>	<i>R. arboreum</i> var. <i>Kermesinum</i>	<i>Arbutus Unedo</i>
<i>Magnolia Delavayi</i> (*)	<i>R. indicum</i>	<i>Abelia floribunda</i> (*)
<i>Abutilon vitifolium</i>	<i>R. mucronulatum</i> (2)	<i>Euphorbia meisei</i> (*)
<i>Fremontia californica</i>	<i>R. "cornubia"</i>	<i>Choisya ternata</i> (°)
<i>Restio subverticillatus</i>	<i>R. Keysii</i>	<i>Desfontainea spinosa</i> (°)
<i>Musa Basjoo</i>	<i>R. spinosiflorum</i>	<i>Lithospermum prostratum</i> (°)
<i>Berthamia capitata</i>	<i>Quercus alnifolia</i>	<i>Ephedra altissima</i> (*)
<i>Pinus Nelsonii</i>	<i>Q. chrysolepis</i>	<i>Cupressus macrocarpa</i> (°)
<i>P. Torreyana</i>	<i>Q. aegilops</i>	<i>Sophora tetraptera</i> var. <i>micro-</i>
<i>P. Taeda</i>	<i>Pistacia vera</i> (*)	phylla
<i>P. brutia</i> (°) (1)	<i>Chamaerops humilis</i>	<i>Convolvulus cneorum</i>
<i>P. leiophylla</i>	<i>Photinia serrulata</i>	<i>Berberis nepalensis</i>
<i>P. Greggii</i> (°)	<i>Embothrium coccineum</i> (°)	<i>Arbutus furiens</i>
<i>P. Teocole</i>	<i>Lomatia ferruginea</i>	<i>Anopterus glandulosus</i>
<i>P. Bonapartei</i> (°)	<i>Eucyphia cordifolia</i>	
<i>Cupressus formosensis</i>	<i>Eriobotrya japonica</i>	

\* On a wall. — (°) Also in another list.

### PLANTS UNINJURED.

<i>Fendlera rupicola</i> (*)	<i>Nolina erumpens</i>	<i>Spartocytisus nubigenus</i> (*)
<i>Ilex latifolia</i>	<i>Dasyliiron serratifolium</i>	<i>Padus ilicifolia</i> (*)
<i>I. canariensis</i>	<i>Erica australis</i>	<i>Fuchsia excorticata</i> (*)
<i>I. Fargesi</i>	<i>E. lusitanica</i>	<i>Fatsia horrida</i>
<i>Yucca Whipplei</i>	<i>E. arborea</i> (°)	<i>Vaccinium Mortinia</i>
<i>Agave Parryi</i>	<i>E. mediterranea</i> (°)	<i>Bryanthus Breweri</i>

(1) Considered by the *Index Kewensis* as identical with *Pinus pyrenaica*.

(2) Considered by the *Index Kewensis* as identical with *Rhododendron dauricum*.

<i>Helianthemum rosmarinifolium</i> (1)	<i>P. Montezumae</i> var. <i>Hartwegii</i>	<i>J. cedrus</i>
<i>Rhododendron Fordii</i> (°)	<i>P. Bonaparteae</i> (°)	<i>J. procera</i> (°)
<i>R. triflorum</i>	<i>Pieris formosa</i>	<i>J. californica</i>
<i>R. Hookeri</i>	<i>Plagianthus Lyallii</i>	<i>J. phoenicia</i>
<i>R. cephalanthum</i>	<i>P. betulinus</i>	<i>J. thurifera</i> var. <i>gallica</i>
<i>R. nereifolium</i>	<i>Kniphofia Northii</i>	<i>J. bermudiana</i>
<i>R. Maddenii</i>	<i>Abies Webbiana</i>	<i>J. Wallichiana</i>
<i>R. Aucklandii</i> (type)	<i>A. Pindrow</i>	<i>Cupressus torulosa</i> (°)
<i>Desfontania spinosa</i>	<i>A. Pindrow</i> var. <i>brevifolia</i>	<i>C. funebris</i> (°)
<i>Lapageria rosea</i> (*)	<i>Pseudo-larix japonica</i>	<i>Tecoma grandiflora</i> (*)
<i>Philesia magellanica</i>	<i>Larix Griffithii</i>	<i>Sargentodoxa cuneata</i>
<i>Gunnera monoica</i>	<i>Libocedrus chilensis</i>	<i>Mandevilla suaveolens</i> (*)
<i>Smilax laurifolia</i>	<i>L. tetragona</i>	<i>Chaetys ternata</i> (°)
<i>Ribes laurifolium</i>	<i>Fitzroya patagonica</i>	<i>Desfontainea spinosa</i> (°)
<i>Clematis ajolata</i>	<i>Dacrydium Franklinii</i>	<i>Griselinia littoralis</i>
<i>Magnolia Campbellii</i> (120 flowers)	<i>Saxegothea conspicua</i>	<i>Illicium religiosum</i>
<i>Elaeagnus umbellata</i>	<i>Glyptostrobus heterophyllus</i>	<i>I. anisatum</i>
<i>E. multiflora</i>	<i>Pittosporum Tobira</i> (*)	<i>I. floridanum</i>
<i>Euonymus fimbriatus</i> (°)	<i>Cupressus glabra</i>	<i>Berchemia racemosa</i>
<i>Berberis japonica</i> (B. al.)	<i>Camellia reticulata</i> (*)	<i>Stuebelia serrata</i>
<i>B. aggregata</i>	<i>Acacia Baileyana</i> (*)	<i>Drimys colorata</i> (*)
<i>B. verruculosa</i>	<i>Athrotaxis cupressoides</i>	<i>Diospyros Kaki</i>
<i>B. dictyophylla</i>	<i>A. laxifolia</i>	<i>Osmanthus armatus</i>
<i>Pinus brutia</i> (°)	<i>A. selaginoides</i>	<i>Parsonia heterophylla</i> (*)
<i>P. mitis</i>	<i>Podocarpus alpina</i>	<i>Quercus Wislizenii</i>
<i>P. cembroides</i>	<i>P. nivalis</i>	<i>Q. thalassica</i>
<i>P. edulis</i>	<i>P. nubigena</i>	<i>Q. cuneata</i>
<i>P. Parryana</i>	<i>P. Totara</i>	<i>Q. virbrayana</i>
<i>P. monophylla</i>	<i>P. macrophylla</i> (°)	<i>Q. imbricata</i>
<i>P. bungeana</i>	<i>Keteleeria Davidiana</i>	<i>Beschorneria yuccoides</i> (*)
<i>P. Gerardiana</i>	<i>Phyllocladus trichomanoides</i> (°)	<i>Olea europaea</i> (*)
<i>P. albicaulis</i>	<i>Tsuga Brunoniana</i>	<i>Pinus insignis</i>
<i>P. Ayacahuite</i>	<i>Romneya Coulteri</i>	<i>Styrax Veitchiorum</i>
<i>P. palustris</i>	<i>R. trichocalyx</i>	<i>Carya tomentosa</i>
<i>P. Montezumae</i> var. <i>rudis</i>	<i>Viburnum Charlesii</i>	<i>Cupressus macrocarpa</i> (°)
	<i>V. rhytidophyllum</i>	<i>Olearia semidentata</i> (°)
	<i>Juniperus oxycedrus</i>	

\* On a wall. — (°) Also in another list.

910 — Flowering of Fruit Trees Influenced by Frost, in the United States. — See No. 894 of this Review.

911 — A New Physiological Theory of Heredity. — RABAUD, ETIENNE, in *Comptes Rendus des Séances de la Société de Biologie*, Vol. LXXX, No. 15, pp. 738-744. Paris, July 28, 1917.

The two chief theories held today on the phenomena of heredity — that of BATESON and that of MORGAN — are both based on the conception of "factors", units independent of each other and also, it would appear, of the living substance itself. These "factors" are purely imaginary; they may, therefore, be multiplied to infinity, and the most incongruous and unlikely properties may be assigned to them. Having once admitted the existence of these factors, the central idea of both theories is their segregation, their division in definite proportions amongst the descendants

(1) Considered by the *Index Kewensis* identical with: *H. lavandulaefolium*; *H. Libanotis*; *H. variabile*; *H. Lippii*; *H. canadense*. (Ed.)



of the hybrids. The questions of dominance or non-dominance take a second place, and the explanations given by BATESON and MORGAN rest only on very improbable hypotheses.

The author addresses the following reproaches to theorists: 1) they have not examined in any way the processes produced in the first generation ( $F_1$ ); 2) they have only studied dominance, or its intermediate stage, in so far as the following process leads to segregation; 3) they have considered the question as if the second generation controlled the first, whereas it is obviously the contrary which occurs; 4) fascinated as they are by segregation they have failed to conceive any uniform function of the organism, whereas the organism is a whole.

Living substance is a complex mixture of colloidal proteins and electrolytic solutions, forming a heterogenous whole of *plastic substances*. These substances are dependent one on the other, their external exchanges are connected with a constant interaction, and the properties of each of them are determined by the very nature of this interaction. The organism is a whole, and it is only by this conception that one explanation can be given of all the various factors of heredity.

*Heredity* is not a vague "factor" giving rise to the theory of an immaterial "power" governing the organism from without; it is simply the continuity and resemblance of particles of living matter derived one from the other. The asexual generation shows this in all its simplicity; the sexual generation gives it a more complex appearance, but it remains none the less essentially a *fact of double continuity and double resemblance* when the two gametes which unite undergo no modification (in the opposite case there is continuity without resemblance; there is no heredity).

From the point of view of peculiarities emphasised by others or together forming peculiarities which, new in appearance, transmit a double resemblance, experiments in heterogenous fertilisation show the deleterious reciprocal actions of the sarcodes of different species. These experiments also prove this action to exist through all the degrees, from the total destruction to the simple physiological inactivity of one of the two united gametes, or of parts of these two gametes; that there is, at times, in this respect, a marked difference between the two sexes, and, finally, that the external influences modify sensibly the interaction of the sarcodes. According to the author all fertilisation due to the union of two gametes from distinct individuals is a heterogenous fertilisation.

Modern genetists admit that a special affinity unites two determined parts of the sarcodes, and that these parts act independently of the others; this hypothesis seems contrary to actual fact. The author, on the other hand, holds that, in the absence of precise data, it is best to state simply that certain parts of one of the gametes do not find conditions favourable to their development in the complex which results from the union of the two gametes.

With regard to the interchangeability of different racial characters in the hybrids of the second generation which may present a mixture of these characters, the author does not admit the theory of autonomous, inter-

changeable "factors". He regards these factors simply as another way of designating chemical bodies; since each property of a chemical body asserts itself under definite conditions, the effects of these properties will vary with the changes which these conditions undergo. All, then, is a function of the whole. When the gametes form in the hybrids of the first generation, a redistribution of the plastic substances is brought about and there result new complexes which differ little from the original sarcode (because this is composed of a certain number of the parts which constituted it previously). The various plastic substances occur in conditions fairly similar to their customary ones because the greatest change they can undergo is a modification of their exchange activity. It follows that, if the new complexes favour the physiological activity of these substances, they produce the effect which they would have produced in the pure gametes, or, at least, a very similar effect; but this effect is only the result of a given complex.

Mendelians do not admit the existence of intermediary forms, but affirm that segregation always occurs, though it is more or less marked in accordance with the number of "factors" participating in it, and which are all similar. Nothing, however, implies the impossibility of the formation of true intermediaries. Exact complete and intermediate dominance are in no way opposed to each other, they are only the extreme degrees of the heterogeneity of the gametes, quite compatible with persistence of the parts which constitute them.

For some Mendelians, the "combinations" produced in the distribution of the characters of the ascendants in the descendants, are actual evolutionary variations, produced solely by hybridisation. According to the author this conception is incorrect, and the different arrangements to which the crossings give rise have no connection with any variation properly speaking. If, at times, from one generation to another, modifications are produced, they are attributable solely to the fact that plastic substances, like all other chemical bodies, are subject to transformation; such transformation occurs especially during the course of their interactions, and may be either lasting or momentary. External influences play an important part. Variation leaves continuity intact, but interrupts resemblance.

In many cases the data gained by experience and observation give no very exact results, but they are preferable to the attitude of impressive precision found in modern works, a precision which is wholly artificial and highly dangerous, and which gives the illusion of the permanent where, essentially, only the temporary exists.

912 — **The Determination of the Seeds of Cultivated Plants.** — FRANÇOIS, LOUIS, in *Annales de la Science agronomique*; I. Year 32, No. 1-6, pp. 30-55, 30 figs. Paris, January-June, 1915. — II. Year 33, No. 1-6, pp. 207-295, 110 figs. Paris, January-June, 1916.

Hitherto no author has collected the seeds of plants in view of their rapid determination with the aid of tables similar to those drawn up for plants. The author has undertaken this work. For the present he has restricted himself to the determination of the seeds of a certain number

of cultivated plants ; later he intends to publish a similar work on the seeds of the most common wild plants.

I. — In the first part seeds are discussed generally, and those of the Leguminosae, Gramineae, Cruciferae, Umbelliferae, and Compositae, the most important families on account of the large number of cultivated species they include, are reviewed successively. These general remarks are illustrated by 30 figures.

II. — The second part is devoted to tables of the characters of the seeds of cultivated plants. These tables allow of their rapid determination, which is still more facilitated by 110 figures, drawn from nature.

**913 — Grass and Clover Seed Imports into the United States** — *Commerce Reports*, No. 107, pp. 498. Washington, D. C., May 8, 1917.

The following table, prepared in the seed laboratory of the United States Department of Agriculture, shows the amount of the various kinds of seeds subject to the seed importation act permitted entry into the United States during the fiscal year ending June 30, 1916, as compared with the nine months ending April 30, 1917 :

Kind of seed	July 1, 1915 to June 30, 1916	July 1, 1916 to April 30, 1917
	Pounds	
Alfalfa . . . . .	3 251 796	2 882 337
Awnless brome grass . . . . .	315	1 442
Blue grass :		
Canada . . . . .	698 300	417 993
Kentucky . . . . .	1 300	
Clover :		
Alsike . . . . .	1 113 464	4 278 900
Crimson . . . . .	4 503 983	5 004 927
Red . . . . .	32 508 536	5 309 461
White . . . . .	148 768	120 464
Millet :		
Hungarian or German . . . . .	117 759	287 787
Broom corn . . . . .	1 101 556	391 740
Mixtures . . . . .	33 297	141 069
Orchard grass . . . . .	754 476	1 286 342
Rape . . . . .	4 018 908	2 015 636
Rye grass : (a)		
English . . . . .	1 510 440	1 513 955
Italian . . . . .	382 811	439 333
Timothy . . . . .	118 737	1 507
Vetch : (a)		
Hairy . . . . .	67 683	223 869
Spring . . . . .	61 613	24 800

a) Subject to the Seed Importation Act since November 1, 1916.



914 - **The Cultivation of Wheat by Hoeing.** — REY, EMILE, in *Journal d'Agriculture pratique*, Year 81, New Series, Vol. 30, No. 18. Paris, September 6, 1917.

The three arguments against the cultivation of wheat by hoeing are :

1) the difficulty, in many cases, of drilling in lines ; it should, however, be easy to construct simple and strong drills at a moderate price, which could be used in practically all soils ;

2) shortage of labour ; this difficulty could be overcome as in cultivation of other crops by hoeing ;

3) the fear of smaller yields owing to the lines being of necessity wider apart.

It was for the purpose of clearing up this last point that the cultivation experiments described in the present paper were undertaken. The results obtained in 1916 with Bordeaux wheat are first discussed.

In order to be able to use horse-drawn machines, a width of 24 ins. was given to the spaces down which the animal was to pass, and these spaces were separated by double lines of wheat 8 ins. apart. Each line thus had half of the large space, 12 ins., plus half of the small space, 4 ins., a total of 16 ins., that is to say, there were two and a half lines to every metre.

Four lines were sown with the following quantities of wheat :

1st. line. — 40 seeds to the metre per line, or 1 seed every 25 mm.

2nd. line. — 40 seeds to the metre, but placed 2 and 2 in holes 0.05 m. apart.

3rd. line. — 20 seeds to the metre, 2 seeds in each hole, 0.10 m. apart.

4th. line. — 13 to 14 seeds to the metre, 2 seeds in each hole 0.15 m. apart.

The yields of the different lines only varied very slightly ; that of the 25 mm. line was just a little greater than the others. Preference should, therefore, be given to close sowing.

In 1916 a yield of 71.37 bushels per acre was obtained from wheat cultivated by hoeing and sown as described above on the 9th. November, 1915.

The experiment was repeated this year with the same Bordeaux wheat, sown and cultivated by the same methods. There were two sowings, one on the 28th. September, 1916, and the other on the 3rd. November, 1916.

The first sowing gave a yield 90.7 bushels. This increase is doubtless due to the early sowing, though this has not been confirmed because, at the time the paper was written, the second crop had not been harvested.

The experiments prove that widening the spaces between the lines in the cultivation of wheat by hoeing, far from causing a decrease in yield, causes a considerable increase owing to the beneficial effect of the hoeing and tillage.

915 - **The Comparative Study of Various Wheats in the United States.** — See No. 953 of this Review.

916 - **Grass Land and Ploughed Land** (1). — STAPLEDON, R. G. (*Adviser in Agricultural Botany, University College of Wales, Aberystwyth*), in *Supplement to the Journal of the Board of Agriculture*, No. 17, 39 pp. London, May, 1917.

FORAGE CROPS,  
MEADOWS  
AND PASTURES

In considering the position of grasslands in relation to the necessity for increased home-grown food in England, the writer insists upon the adoption of a broad point of view. Plans of improvement should aim at obtaining the maximum amount of keep from fields under grass. The possible methods to be employed must therefore not only include drainage, top dressings, or re-seeding, but if necessary, also the adoption of considerably modified rotations.

Grass-land in England is classified as follows :

1. **PERMANENT GRASS.** — Includes fields that have been down for over 20 years.

2. **OUTRUN GRASS.** — Falls under two distinct heads ;

a) *Senile leys*, i. e. leys that have either tumbled down without sowing from a corn-stubble, or owe their origin to an outrun sainfoin breadth or an inadequate original seeding.

b) *Outrun permanent grass*, or grass that has been allowed to deteriorate gradually under bad management.

3. **LEYS.** — Are either :

a) rotation, or

b) temporary meadows or pastures.

The problem for the grass farmer consists of three parts :

1) How, with the labour and machinery and implements at his disposal, to extend his rotation land to stand in a reasonable and economic relation to his area under permanent grass ;

2) How to improve his remaining grass ; and

3) How to establish high class temporary leys.

Dealing first with methods of improvement which do not involve breaking the existing turf and re-seeding or altering the rotations, the means which may be usefully employed are 1) top dressing, 2) renovating mixtures, 3) altered methods of stocking, 4) substituting pasture for meadow conditions or the reverse, 5) eradication of weeds, and 6) drainage.

1) **TOP DRESSINGS.** — The permanent improvement of pastures by top dressings depends chiefly upon the action of suitable treatments on leguminous herbs. In recent years the most remarkable results have been obtained with basic slag ; both it and lime have been shown to exert a profound influence on the spread of white clover and other plants.

2) **RENOVATING MIXTURES.** — A renovating mixture is probably only justified on fields where top dressings are unable to establish a development of leguminous herbs. The seeds to be sown should consist chiefly of wild white clover (*Trifolium repens*), bird's foot trefoil (*Lotus corniculatus*) and yellow suckling clover (*Trifolium dubium*) with a little of such permanent grasses as crested dog's tail (*Cynosurus cristatus*) and rough-stalked meadow grass (*Poa trivialis*) ; perennial rye-grass (*Lolium perenne*) would be added to act as " nurse " and offer some protection to the smaller seedlings when stock are first turned in. Renovating should be followed up with liberal dressings of phosphatic manures. Harrowing may sometimes be necessary to help seeds to obtain a hold.

(1) See also R. 1916, No. 1277.



3) ALTERED METHODS OF STOCKING. — Prolonged grazing with one class of animal only usually leads to deterioration in the herbage. It cannot be too strongly emphasized that grass-land left unmanured and practically ungrazed deteriorates much more rapidly than land over-stocked. The essential point for the grazier to work upon is that proper stocking encourages the valuable indigenous pasture grasses as nothing else will.

4) SUBSTITUTING PASTURE FOR MEADOW CONDITIONS, OR THE REVERSE. — Poor meadows can often be improved by a period of grazing (4 years). The fields should be liberally dressed with basic slag and subsequently with farmyard manure during the period of grazing. Vice versa, poor pastures can be improved by taking one or two crops of hay. A poor pasture consists largely of bent (*Agrostis*), which seeds late. If the hay is cut in good time a preponderant amount of seed will fall from such rye-grass, crested dog's tail and wild clovers as may be present, to the ultimate advantage of the field.

The field should not be manured for the benefit of the hay unless meadow conditions are to be maintained for a considerable period. Liberal manurial treatment would best follow when the field was again used as a pasture. A change from pasture to meadow conditions continued for a period of years tends to suppress such weeds as thistles and soft *Crepis*. and frequently also reduces moss.

5) ERADICATION OF WEEDS. — The writer gives brief notes on the eradication of some of the worst weeds of grass-land.

6) DRAINAGE. — There are large tracts of poor grass-land on retentive clays that could be improved comparatively cheaply by mole drainage. The effect of mole draining on such pastures is not only to carry away excessive water, but also to aerate the soil and therefore to encourage an earlier and prolonged growth of grass.

We now come to the alternative method of improvement, namely by breaking the turf. The writer summarises his conclusions on this part of the paper as follows:

The improvement of grass-land may often be better achieved by the adoption of altered methods of farming than by resort to top dressings and other surface treatments only.

Well conceived plans to extend the acreage under crops in grass districts of high average rainfall should not seek to add only to the arable area, but should also be directed to a regular sequence of highly-productive temporary leys. Indiscriminate extension of the arable area in such districts can only, as in the past, make for subsequent infertility.

It has been shown that it is possible to do much of the ploughing necessary to convert poor grass into rotation land with productive leys, with the additional object of improving permanent grass as such, both during the late spring and summer and in adverse weather during winter.

There is, in consequence, in many districts considerable scope for the employment of motor tractors over a greatly extended period of the year, apart from the preparation of land for the sowing of autumn wheat.

The selection of suitable mixtures is of the utmost importance in con-



nection with farming on the temporary ley basis. At one end of the scale it is necessary that the rye-grass clover mixtures should be reinforced, and at the other end, there is considerable scope for simplification in the complicated mixtures often employed.

# **917 - Action of Artificial Manures on a Mountain Meadow in Switzerland —**

DUSSEER, C., in *Annuaire Agricole de la Suisse*, Year XVIII, Part 1, pp. 7-9. Berne, 1917.

Results of an experiment, lasting from 1914 to 1916, on a pasture situated in the neighbourhood of Riddes (Valais, Switzerland) at an altitude of 1500 metres, with soil formed of schists and gravels poor in lime.

The following manures per hectare (1) were applied at the end of the autumn of 1913:

P: Phosphatic manure 1000 kg basic slag costing 8 francs per 100 kg.  
 K: Potassic " 400 kg. of 30 % potassic salts, costing 14 francs per 100 kg.  
 N: Nitrogenous " 200 kg of sulphate of ammonia, costing 42 francs per 100 kg.

(this manuring was repeated in April 1915).

The following are the results of the 3 years' experiment:

Manure	Dry fodder quintals	Surplus crop		Cost of manuring francs	Profit	
		Weight quintals	Value francs		francs	per cent
None . . . . .	77.0	—	—	—	—	—
Basic slag . . . . .	98.2	21.2	169.60	80	89.60	112 %
Basic slag + potash salts . . .	127.3	50.3	402.40	136	266.40	196
Basic slag + potash salts + sulphate of ammonia . . . . .	157.3	80.3	642.40	304	338.40	111

The botanical composition of the turf for 1916 was as follows:

	Gramineae	Leguminosae	Other plants
Without manure . . . . .	48 %	16 %	36 %
Phosphatic . . . . .	37	30	33
Phospho-potassic . . . . .	36	37	27
Phospho-nitropotassic . . . .	45	30	16

The proportion of red clover increased in proportion as the other plants decreased, the majority of which latter, geranium and yellow rattle, gave a poor forage. The nitrogenous manure favoured the good grasses, the phosphatic and potassic manures favoured particularly the growth of clover and other Leguminosae.

(1) 1 kilo per hectare = 0.892 lbs per acre

918 - **Cotton-Growing in the New Hebrides.** — CORLETTE, EWAN, in *The Agricultural Gazette of New South Wales*, Vol. XXVIII. Part. 6, pp. 438-439. Sydney, June 1917.

In the New Hebrides, the cotton plant grows to a considerable size; though all varieties do equally well, the best return, taking everything into consideration, comes from the Caledonian Dwarf, and for these reasons:

It is exceptionally hardy, of compact habit, and does not deteriorate to any great extent during successive seasons; it is an immense cropper, and the bolls remain on the plant long after they are ripe and are not injured quickly by rain; being of the kidney variety it is very easily picked.

In the New Hebrides, the rainy season begins in December; planting is then started, being continued till the end of February. The plants are put into the ground from 8 to 12 ft. apart in squares, according to the variety; thus Sea Island is planted 8 ft  $\times$  8 ft.; Caledonian Dwarf 9 ft  $\times$  9 ft.; and Caravonica 12 ft  $\times$  12 ft. As a rule, one bunch of kidneys is sown in each hole, and the ground is hoed until the seedlings have attained a good size, when their own shade prevents weeds from growing. At this time, the most vigorous seedling is left in each hole, the rest being thinned out.

The following directions should be carried out, especially in the case of the Caledonian Dwarf variety.

The ground need not be cultivated, or even-stumped — just burnt clean and thoroughly weeded — the seed is hoed in like maize, and sown one inch deep; it is best to put only one kidney in each hole. Picking starts 8 to 9 months after sowing; there are usually 2 crops in the season. One man can keep 4 acres picked clean, going over the plants about every 10 days. One active intelligent man, or woman, can easily pick 60 lbs. of cotton in the boll per day of 9 hours. In the United States of America, the average day's picking for one man amounts to much more. The average yield per acre is  $\frac{1}{2}$  ton. The second crop in the season is about half as large as the first.

About 13 months from planting, the plants are cut back to within about 3 ft. of the ground, preserving the natural rounded shape as much as possible. The next year, the young mature wood is cut to within 6 inches from where it joins the wood of the previous season. The long shoots should be pinched back to promote a bushy shape and prevent the cotton getting out of reach. Plants remain profitable for about 4 years.

The best crops are grown on soils of medium quality; rich soil encourages too much leaf and wood.

Samples of Caledonian Dwarf cotton from the New Hebrides have been valued in England at 1s.2 d. per lb., while Sea Island cotton from the same place was valued at 2s. per lb. The local price of the former variety is about £ 20 per ton.

919 - **Paka Fibre (*Urena lobata*) or Madagascar Jute.** — Investigation carried out in the Jardin Colonial, and published in the *Revue agricole et vétérinaire de Madagascar et Dépendances*, No. 9, pp. 46-47 Tananarive, July 1917.

Samples of Madagascar textiles were sent by the Ivoloïna Station to the JARDIN COLONIAL, at Nogent-sur-Marne (France) with a request for information as to their commercial value. Among these samples was one of Paka fibre, as yet little known in commerce.

The investigation gave the following results:

In appearance and quality Paka resembles *Corchorus* fibre, but its filaments are often markedly shorter than those of the true Indian jute. It might be possible to remedy this to a certain extent by close sowing and a careful choice of the soil in which the crop is to be grown.

The fibres might be classed according to their shade, which varies from white to reddish.

The sample was of good average strength.

The opinions of manufacturers who examined the fibre were very various. Those who habitually use Indian jute were opposed to the use of *Urena lobata*, and affirmed that this fibre, like all other similar textiles derived from the Malvaceae family, is only suited for use in native factories where labour is cheap. Other manufacturers realised that Paka fibre closely resembles jute, except in the length of its stalks, which are shorter than those of the *Corchorus* family.

It seems that Madagascan *Urena lobata* may be used in a similar way to Calcutta jute in the preparation of packing sacks and cloths, and manufacturers seem inclined to buy it.

It appears that *Urena lobata* is used commercially in South America under the name of *Armina*, and is specially suited to the manufacture of packing sacks and cloths.

920 - **Oil-Producing Plants of French West Africa.** — FRANÇOIS, G., in *Bulletin de l'Office colonial*, Year 10, Nos. 113-114, pp. 223-269. Melun, May-June, 1917.

OIL-YIELDING  
PLANTS

The products of oil-producing plants are by far the most important of West Africa, both in quantity and in value. Some are already being exported in increasing quantities, others have only recently been put on the market, whereas yet others will be put on the market before very long.

Those of the first category are, in order of importance: pea-nuts, palm nuts and oil, copra, shea butter, sesame, castor-oil. Then come the seeds of Deccan hemp (*Hibiscus cannabinus*), of kapok, cotton, *Dumoria*, "finz-an", "benefing", horse-radish tree (*Moringa Pterygosperma*), physic-nuts, (*Jatropha Curcas*), "lamy" or "tama" (*Pentadema oleracea*). "kabi" or toulou-couma (*Carapa Touloucouma* Guillemain and Perrottet, *Carapa guineensis* Don), African oak (*Lophira alata*), argemone; these are all secondary products which are not included in the statistics.

**Pea-nuts.** — Nearly all of these come from Senegal, but a small proportion also come from Upper Senegal and Guinea. Before long pea-nuts will also be exported from the Ivory Coast.

The average yield for Senegal has been estimated at 8 cwt. per acre; in good soils it is almost 16 cwt. per acre; 1 bushel of pods weighs 24 lbs.; the decorticated seeds represent, on the average, 75 % of the weight of the whole fruit. They are exported in the shell, but it would be well to decorticate them on the spot.

The different varieties of pea-nut are:

- 1) French West Africa: North of Rufisque (extra Cayor, Rufisque, superfine Rufisque).
- 2) French West Africa: South of Rufisque.



- 3) French West Africa : Soudan, Gambia, Guinea.
- 4) India and Coromandel.

The best quality ones are those from Senegal ; the Cayer and Rufisque varieties may give as much as 32 % of oil, and 45.82 % if they are decorticated.

The results of analyses carried out by M. AMMANN (Professor of the High School of Colonial Agriculture of France) are given. These show clearly the high value of French West African pea-nuts, as well as that of the straw, bran and cakes in the feeding of animals.

Attention is drawn to the value of pea-nut cake as a foodstuff for cattle, and the latest work done on this subject (1), and to the fact that M. AMMANN's experiments have shown that pea-nut flour may be used for human nutrition in bread and biscuits without leaving an unpleasant taste of any kind.

The means of protecting the nuts against natural enemies (particularly white ants), against drought, etc., together with the improvements to be carried out, are given.

In Senegal, the trade in pea-nuts rose from 27 221 tons, of a value of £207 271, in 1890, to 305 067 tons of a value of £2 286 837 in 1915. In the Niger Upper Senegal in 1913, the figures were 8 577 tons of a value of £99 295. In French Guinea the trade increased from 560 tons in 1910 to 1266 tons in 1915.

*Oil Palm (Elæis guineensis).* — Palm oil is next in importance to pea-nuts and is the fundamental factor of the wealth of Dahomey. It would be well if good commercial methods of extraction were adopted on the spot.

M. AMMANN's analyses are given, together with the following figures for the exports in 1915 :

	Palm oil Tons	Nuts Tons
Casamancy (Senegal) . . . . .	—	1 724
Guinea . . . . .	374	5 829
Ivory Coast . . . . .	4 983	6 113
Dahomey . . . . .	9 598	23 224

It would be advantageous to extract the oil from the palm-nuts before exporting them, as the oil thus obtained is of better quality than that extracted from the nuts after they have been shipped.

*Cocunut.* — This is cultivated for its products on the Ivory Coast and in Dahomey only.

Copra is being used more and more in oil and soap factories, as well as in the manufacture of vegetable butter, and thus has almost unlimited markets. The quotations for this product are increasing continually, and, whereas at Marseilles, in 1913, it was quoted at £1.12.6 to £2.9.6, it varied from £4 to £5.4.0, in 1916.

(1) See R. May, 1917, No. 463

(Ed.)

The results of M. Ammann's analyses of copra oil and cake are given.

The following other important products are reviewed in a similar, but less detailed, manner: — shea butter, sesame, Deccan hemp, kapok and cotton. Their production has not yet been greatly developed in French West Africa, but it is continually increasing, and capable of becoming of great importance.

Oil-producing plants are of great importance in the French West African export trade: in 1915 they amounted to £2 960 000 out of £4 760 000 of the total exports; this represented 304 000 tons of pea-nuts, 15 000 tons of oil and 36 890 tons of palm-nuts.

921 - **Sugar Cane Cultivation and Sugar Manufacturing in Eastern Bolivia.** — BLOOM FIELD, H. E. (British Vice-Consul at Santa Cruz), in *The Board of Trade Journal*, Vol. XCVII, No. 1063, pp. 86-87. London, 1917.

SUGAR CROPS

Sugar cane grows luxuriantly in eastern Bolivia, attaining a great height, and the crop is seldom injured by frost. The cultivation is conducted in the most primitive manner. The land is cleared and the undergrowth burned, the tree trunks that can not be made into firewood being left to rot in the ground. The planting is done by jabbing oblique holes with a long sharpened stake, about 3 feet apart, and inserting a piece of cane. The cane soon sprouts, after which the ground has to be cleared of weeds. The weeding must be repeated until the cane is tall enough to smother the weeds. The ground is never ploughed or irrigated: cultivation consists simply of destroying the weeds, which is all done by hand labour with a small native pushing hoe. In about 10 months the cane is ripe and ready for cutting. Two or three weeks after cutting the cane leaves are dry enough to burn, when fire is applied and the whole field burned off. The cane roots soon sprout again, and the same weeding operations have to be gone through as in the previous year. This process is continued year after year until the field has to be replanted; this replanting is repeated three or four times, when the ground becomes exhausted, and the field is then abandoned and the planter changes to new ground.

Sugar is made by boiling the cane juice in a copper cauldron until it becomes of the proper consistency, when it is transferred to earthenware crocks with a hole at the bottom for the molasses to drain from. The refining is done by the claying process. The molasses is made into alcohol. Many planters still use the antiquated wooden sugar mills, and most of the iron mills in use are operated by animal power. Owing to the immense cost of transportation in eastern Bolivia, even a comparatively small steam mill requires considerable capital to buy, import, and install, besides having to wait at least a year from the date of ordering until it is set up and in working order. Another reason for using the old mills is that the native planter has no love for machinery, being in consequence, ignorant respecting it, and either can not or will not learn anything about a steam engine. There are only 15 steam-power sugar mills in all eastern Bolivia. The animal-power mills are generally worked by means of oxen.

During the year 1914 Bolivia imported 8 500 tons of sugar, valued at £200 000 for consumption in the western Departments. Even under the



present disadvantages of transportation all this sugar could have been produced in the Department of Santa Cruz.

922 - **Sugar Cane and the Chemical Modifications it Undergoes after Cutting under the Climatic Conditions of India.** — See No. 907 of this *Review*.

## FORESTRY

923 - **The Experimental Plantations of Vallombrosa, Italy.** — PICCIOLI, L. (Professor of Forestry and Technology at the Royal Institute of Forestry, Florence), *Gli Arboreti Sperimentali di Vallombrosa*, 99 pp. Florence, 1917.

The experimental plantations of Vallombrosa are under the control of the Department of Forestry, Apiculture and Technology of the Royal Institute of Forestry of Florence. They are situated at a height of from 2 886 to 2 952 feet, cover an area of 21 acres, and are divided into 6 parts. The first part, started in 1869 by BÉRENGER, is chiefly used as a nursery for plants for replanting woods; the others, planted by PERONA, form the richest collection of trees in Italy. The average temperature of Vallombrosa varies from a minimum of  $-0.1^{\circ}\text{C}$  to a maximum of  $27.7^{\circ}$ ; the annual precipitation is 1531.2 mm. during an average of 137 days. Observations carried out during 3 years in the field and in the pine wood bordering on the plantation, showed the evaporation to be 548.96 for the field and 358.65 for the pine wood. The plantation has a clay or silicious sub-soil, and soil formed largely by disintegrating sandstone.

A list of the various trees in order of their families and genera is given, together with their maximum height, their circumference at 1 metre from the ground, and their age, as well as the countries in which they grow wild.

This list shows that the plantation includes trees belonging to 76 families, 244 genera and 1 337 species, among which are 39 *Pinus*, 17 *Picea*, 23 *Abies*, 17 *Thuja*, 24 *Cupressus*, 26 *Juniperus*, 55 *Salix*, 20 *Quercus*, 39 *Pyrus*, 45 *Crataegus*, 35 *Prunus*, 36 *Acer*, 22 *Fraxinus*, and their varieties.

## LIVE STOCK AND BREEDING.

## HYGIENE

924 - **Contribution to the Study of "Tembleque" (1).** — RIVAS, HERACHO in *Anales de la Sociedad Rural Argentina*, Year I, II, Vol. I, I, No. 4, pp. 338, 1 fig. Buenos-Aires, June, 1917.

About 5 years ago and again quite recently the writer observed several cases of "tembleque" in the neighbourhood of La Plata, among animals grazing on pasture where close examination showed no plants of *Paspalum dilatatum*. The graminaceous host of the fungus causing the disease in this particular case was *Sporobolus indicus* and the fungus *Napicladium Ravenelii* (B. C.) Speg. (both identified by SPEGAZZINI). The symptoms of the "tembleque" are very similar to those of the "tembladera" caused by *Festuca Hieronymi* infected by the fungus *Endoconidium tembladerae* Rivas and Zanolli.

(1) See also *R.*, September 1917, No. 829.

(Ed.)



925 - **The Sheep Tick and its Eradication by Dipping.** — IMES, M., in *United States Department of Agriculture, Farmers' Bulletin* 798, pp. 31, 15 figs. Washington, D. C., May, 1917.

The Sheep Melophagus (*Melophagus ovinus*), wrongly called sheep tick in the United States, is a blood-sucking ectoparasite which infects sheep kept both on farms and on ranges. This parasite is very common and spreads rapidly, especially among sheep on over stocked pasture-land, where it may cause very serious loss.

The biological cycle and habits of the insect, together with the methods of identifying it, are described.

Dipping is the only practical method of destroying the parasite. Two dippings are necessary with an interval of 24 days between them, because the first dipping may not destroy all the pupae, which may subsequently hatch a new brood. Various kinds of dips may be successfully used — soap emulsion, coal-tar-cresote, 0.07 % nicotine, soap and cresylic acid (0.50 %), lime-sulphur-arsenic. The cost varies from 2 to 3 ½ cents per head for each dipping. The lime-sulphur-arsenic dip was found the most satisfactory. It is made by mixing standard strength lime-sulphur dip with ½ - standard strength arsenical dip.

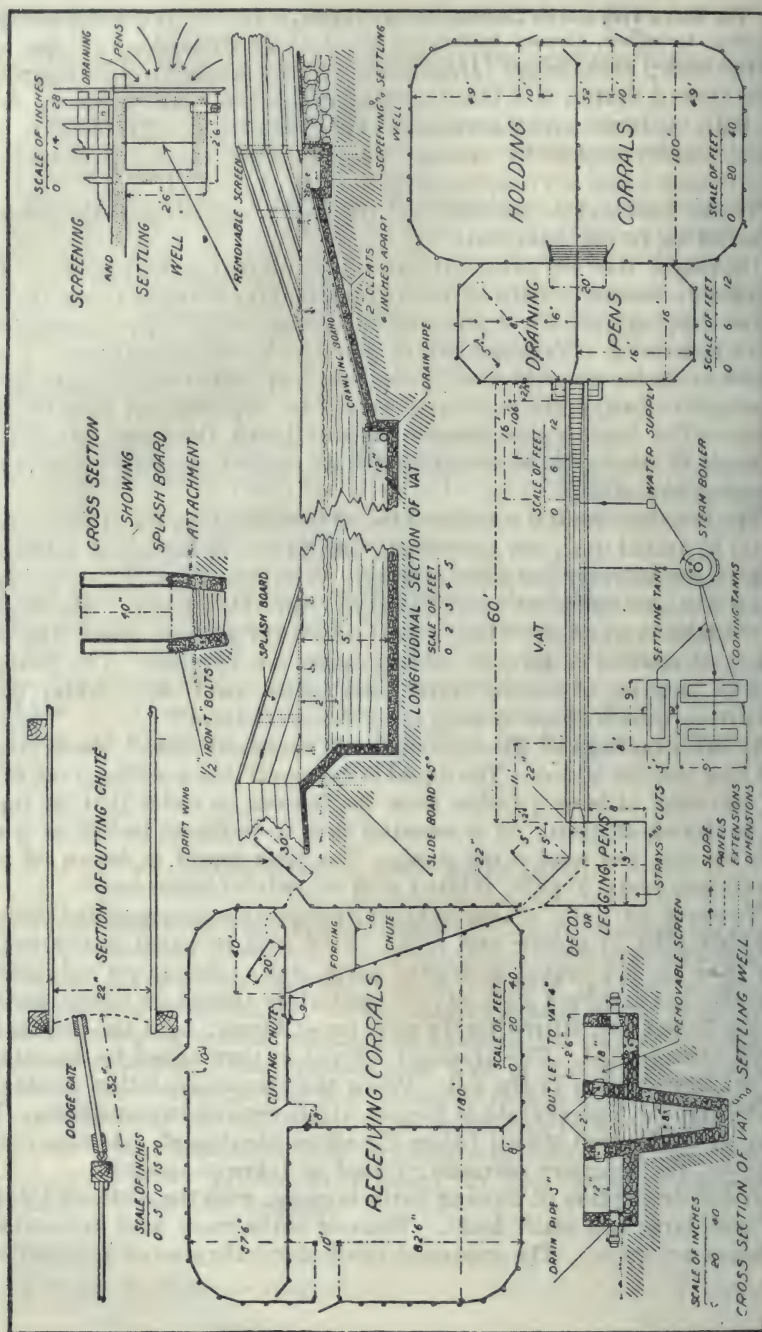
The lime-sulphur dip contains 8 lbs. of unslaked lime (or 11 lbs. of commercial hydrated lime, not air-slaked), and 24 lbs. of flowers of sulphur or sulphur flour, to every 100 galls. of water. The lime is put in a water-tight, shallow box, and sufficient water added to form a thin paste. The sulphur is sifted into this and the whole is well mixed till a paste, about the consistency of mortar, is formed, adding water as required. The paste is added to 30 galls. of boiling water, and boiled for 1 hour, water being added from time to time to keep the volume constant.

If, after boiling, all the sulphur is not dissolved, small quantities of extra lime may be added. The liquid is drawn off into a settling tank fitted with an outlet at least 4 inches from the bottom, in order that the liquid may be drawn off clear. It is essential that no sediment be left, as it will injure the eyes and wool of the sheep. The clear liquid is drawn off into the vats and every 30 galls. diluted with 70 galls. of warm water.

To every 500 galls. of lime-sulphur solution thus prepared and diluted, are added 4 lbs. of arsenic and 12 lbs. of sal soda prepared as follows: 12 galls. of water are heated to boiling point and 12 lbs. of sal soda added. When this has dissolved 4 lbs. of powdered white arsenic are added, and the mixture boiled and stirred for 15 minutes or longer, until the arsenic has entirely disappeared. The arsenical solution is then added to the diluted lime-sulphur solution in the vat. When the arsenical solution is added a yellow, flocculent precipitate is formed which remains in suspension. The liquid should be well stirred before the sheep are dipped. As this dip is poisonous, the necessary precautions must be taken in using it.

A full description of dipping baths is given, with the methods for dipping both large and small flocks. Plans of baths made both in wood and in cement are given. The appended figure shows the plan of a cement vat.

Plan of sheep dipping plant; cement vat.



926 - **The Physiological Action of Symbionts.** — PORTIER, PAUL, in *Comptes rendus des Séances de l'Académie des Sciences*, Vol. 165, No. 7, pp. 267-269: Paris, August 13, 1917.

In a preceding paper read before the Académie des Sciences (1) the author gave the morphological and bacteriological characters of micro-organisms which he had isolated from animal fat tissues.

The author considers these microorganisms to be symbiotic micro-organisms, or symbionts, whose actions on the various elements of the organism reproduce those which occur within the tissues. Their physiological properties are :

1) remarkable synthetic actions ; for example, the polymerisation of sugars with formation of a polysaccharide resembling glycogen ;

2) the utilisation of nitrates to form organic nitrogen (the same phenomenon occurs in the organism of mammals).

On the other hand, investigations started in 1912 show the symbionts to be capable of the following actions among others :

1) transformation of amino acids, liberation of ammonia, decarboxylation, oxidation (oxidation of glycerine to dioxy-acetone) ;

2) transformation of a neutral salt into an alkaline carbonate, thus forming a medium adapted to the life of the cells, and one in which allo-tropic isomeric changes of various sugars can take place ;

3) the formation, with alcohols, of bodies having a cetonic function.

Apart from their ordinary action, the various symbionts isolated from animals present secondary differences connected with their origin, which shows that every species has a specific symbiont.

Facts of another order, in appearance very dissimilar to the preceding ones, may yet be compared with them very profitably.

The author repeated Funck's experiments and those of Weill and Mouriquand on vitamins and malnutrition (2). He obtained the same principal results as these workers, and gives an account of them.

The animals (pigeons), fed with decorticated grain, lost weight and finally collapsed, showing special trouble in movement.

Vegetable symbionts, similar to those of animals, exist in the tegument of grain ; they are absent, or very rare, in the centre part. Pigeons fed on grain with its tegument which has been heated in a moist atmosphere to a temperature above 120°C, lose weight and die, showing the same symptoms as those in the preceding experiment. The same grain heated to 100°, or even to 110°, keeps the birds alive. The symbionts, in a moist atmosphere, resist to 100°, or 110°, but are destroyed at a temperature above 120°.

Milk drawn aseptically appears always to contain symbionts in the fat. Milk heated to 100°, or even 110°, sustains mammals, but, when heated to 120°, the animals fed on it die (infantile scurvy).

In short, both the destruction and elimination of the symbionts from food produce malnutrition. It is very difficult to admit that this can be a matter of pure coincidence.

(1) *Comptes rendus de l'Académie des Sciences*, Vol. 165, p. 197, 1917. (Author).

(2) See R. 1916, No. 663. (Ed.)



If a pigeon suffering from malnutrition and already paralysed and on the point of death, is fed with symbionts in some convenient form, it shows a rapid and very striking improvement. The experiments carried out by the author on this subject are few in number and incomplete; but others are in progress.

The symbionts of xylophagous insects, those of the fat tissues of other insects and larvae, the symbionts obtained by culture *in situ* in the fat tissues of vertebrates, may all be shown up by REGAUD's method for the differentiation of the mitochondria. This microscopical method is so certain from this point of view that the author always uses it to seek symbiotic bacteria in insects.

927 - Gradual Conversion of Colostrum into Normal Milk. — *Oesterreichische Molkerei Zeitung*, Year XXIV, No. 14, p. 129. Vienna, July 15, 1917.

During the course of last year the Station for Milk Control at Memmingen (Bavaria) made a series of analyses with the object of following the gradual transformation of the colostrum of milch cows into normal milk. The results of these analyses are given in the appended Table.

### Results of Analyses

Age of colostrum in days	Specific weight at 15° C	Fat content	Dry matter	Dry matter devoid of fat	Acidity H <sub>2</sub> SO <sub>4</sub>	Refractive index
1/2	1.0745	5.60 %	25.60 %	20.00 %	13.60	—
1	1.0392	3.80	14.62	10.82	9.20	—
1 1/2	1.0350	4.20	14.05	9.85	11.20	39.2
2	1.0341	3.70	13.22	9.52	10.00	39
2 1/2	1.0365	3.90	14.06	11.16	10.00	39.8
3	1.0333	3.60	12.90	9.30	9.20	39
3 1/2	1.0335	4.00	13.43	9.43	9.20	40
4	1.0323	3.60	12.65	9.05	8.40	39
4 1/2	1.0337	3.80	13.20	9.44	8.40	39.8
5	1.0321	3.80	12.84	9.04	8.40	39.2
5 1/2	1.0331	3.83	13.12	9.29	8.00	39.8
6	1.0321	3.65	12.66	9.01	8.20	39.7
6 1/2	1.0322	3.68	12.72	9.04	8.80	39.9
7	1.0312	3.70	12.50	8.80	8.00	39.6
7 1/2	1.0326	3.70	12.85	9.15	8.00	39.9
8	1.0316	3.63	12.51	8.88	8.00	39.4
8 1/2	1.0324	3.45	12.50	9.05	8.80	40.8
9	1.0329	3.73	12.95	9.22	8.00	40.6
10	1.0316	3.70	12.60	8.90	7.20	39.7
10 1/2	1.0331	3.40	12.61	9.21	7.20	40.8
11	1.0322	3.58	12.60	9.02	7.20	40.8

This Table shows that if with certain data, the milk has reached the normal figure as early as the 5th. day, the acidity only becomes normal on the 10th. Further, the relation between casein and albumen and the fer-

mentation experiments have shown that the milk is not capable of caseification before the 10th. day and that, for selling milk for direct consumption it is advisable to wait till the 14th. day, on account of the facility with which the milk of the preceding period adheres to cooking vessels and acquires a burnt flavour.

928 - **Alfalfa Silage.** — REED, O. E., in *Kansas State Agricultural College, Agricultural Experiment Station Bulletin* No. 217, pp. 1-20. Manhattan, Kansas, May 1917.

Seven small silos were erected in the spring of 1914 at the Kansas Experiment Station with the purpose of studying alfalfa silage. The experiment was carried on for two years, the silos being filled for the first time in the spring of 1914 and again in the spring of 1915.

The following combinations of material were siloed :

## First year

Alfalfa alone.  
Alfalfa and corn chop, 10 to 1.  
Alfalfa and blackstrap molasses, 20 to 1.  
Alfalfa and alfalfa-molasses feed, 10 to 1.  
Alfalfa and straw, 4 to 1.  
Alfalfa and green rye, 2 to 1.  
Rye alone.

## Second year

Alfalfa alone.  
Alfalfa and blackstrap molasses, 20 to 1.  
Alfalfa and blackstrap molasses, 10 to 1.  
Alfalfa and corn chop, 10 to 1.  
Alfalfa and sweet-sorghum stover, 6 to 1.  
Alfalfa and green rye 2 to 1.  
Rye alone.

A palatability test, conducted each year, obtained information as to how cattle would relish the various combinations. Chemical analyses were made of the silage by the chemistry department. Bacteriological study was also made of the silage by the bacteriology department. Some of the chemical analyses are reported in this bulletin, but a detailed report of the chemical and bacteriological studies will be published separately.

During the first trial several difficulties such as insufficient weight to insure proper packing and method of sampling were encountered, but these were overcome during the second trial.

A summary of the chemical analyses of the second year experiments is given in Table I. The first analysis in each case represents the composition of the mixture as it was run into the silo. The samples for the second analysis were composites taken several times during the process of silage making and represent the finished product.

The palatability tests showed that the silages containing the highest percent of acid were most palatable to the cattle.

The following deductions were made :

Alfalfa will make a fairly good quality of silage and it will be readily eaten by cattle if fed within a few months after being siloed.

Observations during the experiment indicate that when it is possible to make alfalfa into first-class hay it should not be put into the silo. During a rainy season it is almost impossible to get the hay up without some damage and under such condition siloing may be justified.

The addition of carbohydrate material, such as corn meal, blackstrap molasses, sweet-sorghum stover and green ryes to alfalfa when put into the silo resulted in preserving it for a longer time than when the alfalfa was sil-

TABLE I. — *Percentage composition of alfalfa silage. Second trial 1915-1916.*

Silo No.	Description of Sample	Moisture	Ash	Protein	Crude fibre	Nitrogen free extract	Ether extract	Acidity	Sugar
1	Alfalfa alone.								
	When filled . . . . .	62.75	4.60	6.94	10.32	13.63	1.76	0.450	1.039
	Taken out . . . . .	67.23	4.17	5.51	9.75	12.23	1.11	1.483	—
2	Alfalfa and molasses, 20 : 1.								
	When filled . . . . .	70.83	3.21	4.75	6.93	13.10	1.18	0.394	1.157
	Taken out . . . . .	73.08	2.80	4.48	7.67	11.00	0.97	2.413	—
3	Alfalfa and molasses, 10 : 1.								
	When filled . . . . .	64.85	4.95	5.31	7.53	16.07	1.29	0.389	5.890
	Taken out . . . . .	63.53	5.22	5.93	9.49	14.44	1.39	3.009	—
4	Alfalfa and corn chop, 10 : 1.								
	When filled . . . . .	66.80	3.25	5.25	7.21	16.02	1.47	0.378	0.900
	Taken out . . . . .	67.08	5.23	5.10	8.59	12.79	1.20	2.242	—
5	Alfalfa and sorghum stover, 6 : 1.								
	When filled . . . . .	64.75	4.15	5.69	10.54	13.27	1.60	0.387	0.696
	Taken out . . . . .	62.30	5.56	5.51	11.26	13.82	1.55	1.856	—
6	Alfalfa and rye, 2 : 1.								
	When filled . . . . .	63.25	5.36	6.00	9.23	9.18	1.58	0.495	3.170
	Taken out . . . . .	67.40	4.21	4.93	10.20	11.86	1.40	1.975	—
7	Rye alone.								
	When filled . . . . .	62.25	3.65	3.80	6.17	23.05	1.08	0.450	1.870
	Taken out . . . . .	62.27	3.72	3.83	13.17	15.67	1.34	1.917	—

oed alone. Of the supplements used in these experiments blackstrap molasses proved to be the best, corn chop was next in order, followed by sweet-sorghum stover and green rye. The mixture of alfalfa and blackstrap molasses was the most practical one used. Inasmuch as the addition of the molasses to alfalfa did not increase the bulk, it was possible to preserve large quantities of alfalfa within a comparatively small space.

There is as much acid produced in alfalfa silage as in kafir or cane silage. This would indicate that the acid content of silage is not always an index to the quality of the silage.

Rye alone will make a fair quality of silage when preserved in large silos and cut when the grain is in the late milk and early dough stages.

## BREEDING

929 — **Studies of Free-Martins.** — I. LILLIE, FRANK R.: The Free-Martin; a Study of the Action of Sex Hormones in the Foetal Life of Cattle, in *The Journal of Experimental Zoology*, Vol. 23, No. 2, pp. 371-452, figs. 29. Philadelphia, Pa. July 5, 1917. — II. CHAPIN, CATHARINE LINES, A Microscopic Study of the Reproductive System of Foetal Free-Martins, *idem.*, pp. 453-482, figs. 16.

A research into the cause of the sterility which is the rule (subject to a few exceptions) in the female of two-sexed twins of cattle. The writer's theory has already been discussed in a previous publication (1), the present

(1) *Science*, N. S. Vol. 43, pp. 611-613.



paper now deals with the data and analyses the facts in a more ample manner.

The view taken by the writer is that the free-martin is zygotically female. The only basis on which it could be logically interpreted as male is that it is co-zygotic with its male mate, because it is impossible to suppose that the association of two males in *utero* should cause the transformation of one of them into a free-martin in a certain definite proportion of cases. The embryological evidence, however, based on the occurrence of a *corpus uterum* in both ovaries of 22 pregnant animals examined by the writer, shows that the free-martin and its male mate arise from separate zygotes. From this point of view the free-martin must be interpreted as zygotically female. Other proof of the author's view is afforded by the somatic resemblance not being as close as that of identical twins and the fact that interpretation of the female as male leads to an absolutely incomprehensible sex-ratio. The fact that the internal reproductive organs of free-martins are more or less of the male type is regarded as inconclusive.

The question now becomes how the association of a male and female *in utero* may affect the female in the way it does.

Examination of twin pregnancies in cows has shown that the chorions of the 2 foetuses usually become fused at an early stage and this is followed by anastomosis of the blood vessels of the two sides with resulting intermixture of the blood of the two foetuses. It is this condition which has suggested the theory of hormones. At the time of sex-differentiation in cattle there is an active secretion of male sex hormones which pass into the blood and thus in the case of twins by means of the vascular anastomosis reach the circulation of the other twin. It is the limiting effect of the male hormones upon the female reproductive organs that causes the sterility and other features of the free-martin. The natural query now is why the intermixture of the blood being reciprocal, the effect is exclusively on the female? The answer is afforded by reference to well-known facts not hitherto correlated with the phenomena in question and in certain new facts which are described in the 2nd. paper, by CHAPIN, to which the reference is given at the head of this summary. These facts are: 1) the early development of the interstitial tissue of the mammalian testis, from the very beginning of sex-differentiation, and 2) the fact that the differentiation of the ovary is later than that of the testis. Thus 1) interstitial tissue of the testis is present at the time for which male hormones are postulated, and 2) the testis has a start over the ovary in this respect which results in the suppression of specific ovarian tissue from the beginning. Hence no conflict of sex hormones arises nor can there be any question of the male of two-sexed twins being influenced in its sexual development by its mate.

It is obvious from the above that the hormone theory of free-martins is based on the fusion of the chorions of the twins where free-martins occur, and anastomosis of the foetal blood-vessels. Consequently, if a single case of two-sexed bovine twins occurred in which the foetal vascular anastomosis was absent and in which the female was nevertheless a sterile free-martin, the hormone theory would have to be abandoned. No such case,

however, has been found; it can therefore be safely said that foetal anastomosis of two-sexed twins involves the sterile condition of the female, and absence of such anastomosis its fertile condition.

The last part of the paper is devoted to the embryonic and adult anatomy of the free-martin, the microscopic anatomy being discussed in the 2nd. paper, by Miss CHAPIN.

Bibliographies are attached to both papers.

930 - **Family Performance as a Basis for Selection in Sheep.** — RITZMAN, F. G. and DAVENPORT, C. B., in the *Journal of Agricultural Research*, Vol. X, No. 2, pp. 93-97. Washington, July 9, 1917.

Two methods of selecting mates are in current use. The commonest is that of picking out the best individuals or those that exhibit the traits which are desired in the offspring, and is based in the principle that the somatic traits of the parent are the best index of its germinal determiners, so that somatic selection is, at the same time, gametic selection. This principle is, however, false, because the animal may be heterozygous in any trait, that is to say that, besides determiners for a certain character, it may also have allelomorphic cells where this character is absent. For this reason this method gives very slow progress, and sometimes none at all.

The second method of selection is based on the principle that the individual's somatic traits constitute a partial and imperfect index to its germ plasm, and that a better index is obtained by considering the characters of as many close relatives as possible.

These principles have been applied in the sheep breeding experiments carried out at the New Hampshire Experiment Station. The aim of the experiments is to produce a race of sheep combining good qualities of conformation, size and wool. These qualities were judged by the following scale of 100 points:

**SIZE.** — Body weight, 5 points; height at shoulder, 5 points; chest circumference, 5 points; loin width, 5 points; hind-leg circumference, 5 points.

**WOOL.** — Weight of fleece, 10 points; length of staple, 10 points; diameter of fibre, 10 points; crimp of wool, 10 points.

**CONFORMATION.** — Ratio, head width: length, 3 points; ratio, neck length: circumference, 2 points; ratio, fore-leg length: trunk length, 10 points; ratio, chest width: depth, 5 points; ratio, chest width: trunk length, 5 points; ratio, loin width: trunk length 5 points; ratio, croup length: trunk length, 5 points.

As only a few rams are bred, selection is much more rigorous for males. The general method of selection is illustrated by the following example: In the 1916 selection the available ram lambs belonged to 12 "families". A "family" includes brothers, sisters, and the two parents. In selecting the character "body weight", the average weight of all the members of each family group at a fixed age is calculated. The family having the highest average weight is graded 1; the next highest, 2; and so on. If two families have the same average they receive the same number. Naturally, each family has different numbers for each character. When the rank of each family with respect to every quantitative trait has been determined,



the rank is multiplied by its appropriate weight factor, as in ordinary scoring. The family which gives the lowest sum of products grades highest.

The rank of the families having been thus established the best ram is chosen from each. In this case the individual is also considered. If, for example, the best ram from the best family is sickly or has any physical defect, he is discarded for the best ram of the next best family. Thus the consideration of the relative values is supplemented by that of the "ideal" type at which the selection aims.

These experiments are not yet finished, but the uniformity and excellence of the progeny obtained already show that this method is well worth the extra labour it entails.

931 - **Investigation in Animal Nutrition: Beef Production.** — HAECKER, T. I., in *The University of Minnesota Agricultural Experiment Station Bulletin* No. 155, pp. 1-32. St. Paul, Minn., March, 1916.

CATTLE

This bulletin gives the results of 7 years' experiments on the food requirements of beef cattle from their birth up to 1 year, 2 and 2 ½ years of age.

The experiments were started in the autumn of 1891, at the same time as those on the feeding of dairy cows, which lasted 15 years, and the results of which have been published in Bulletins Nos. 130 and 140 of the Minnesota Experiment Station.

The real experiments on beef-bred calves were, however, not begun on a large scale till 1907-08. The experiments were divided into 5 series, with 7 groups of selected beef calves. Besides a quantitative and qualitative study of the food required for the production of beef animals during the periods of growth and fattening, the cost of production was also considered. Although the data included in the second part of this study must necessarily depend on the cost of foodstuffs, yet they are of great importance, because they clearly show the *progressive curve of the cost of foodstuffs per pound of gain*. Table I summarises, in the last column, the average cost, for the 7 groups, of 1 lb. of gain during the six periods of growth corresponding to the 6 classes of animals used in the experiments. The curve is not modified by variation in the cost of foodstuffs. The other columns of Table I include the average live weight per class or period, the average increase in live weight, the whole milk, skim milk, concentrated foodstuffs, hay and silage consumed during the various stages of growth, as well as the quantity of each concentrated foodstuff given.

The data in Table I refer to experiments with steers kept in the shed without ever being turned out to pasture, but take into account all liberty given necessary to the animal's physical welfare.

Table II summarises data obtained from animals of two groups which, during their 2nd. year, were turned out to pasture in summer for 140 and 153 days respectively, and kept in the shed during the period preceding or following that of open pasture. It is seen that grazing reduces the quantity and, consequently, the cost, of the foodstuffs given during the 21 weeks of pasture by \$ 10.55 per head, with a minimum of \$ 6.6 and a maximum of \$ 14.50 per head.



TABLE I. — *Average Weight of Steers, Feed Consumed per Steer, and Cost of Gain during different periods of growth.*

Periods — lbs.	Weight — lbs.	Gain — lbs.	Milk — lbs.	Skim Milk — lbs.	Grain Mixture — lbs.	Hay — lbs.	Silage — lbs.	Average amounts of the various Feed-Stuffs in the grain Mixture						Cost per lb. of gain (1) — Cents
								Corn — lbs.	Barley — lbs.	Bean — lbs.	Oil Meal — lbs.	Midcl. — lbs.	Oats — lbs.	
to 100. . . . .	111.7	—	244	40	—	—	—	—	—	—	—	—	—	10.6
100-200. . . . .	199.2	87.5	216	879	95.6	106.6	6.9	24.7	6.7	26.8	21.6	7.7	7.7	7.5
200-300. . . . .	299.6	102.4	—	577	198.1	236.7	132.3	39.0	21.0	59.3	46.1	16.1	16.1	4.9
300-400. . . . .	401.6	100.0	—	163	56.0	297.7	332.3	48.4	28.9	77.3	62.5	19.5	19.4	5.0
400-500. . . . .	502.5	100.9	—	—	301.9	333.8	476.8	62.5	26.7	93.9	71.0	21.5	26.3	5.5
500-600. . . . .	601.5	99.0	—	—	286.8	319.4	417.1	60.9	23.1	89.9	66.6	20.2	26.1	5.3
From calf to 12 months	—	489.8	460	1 659	1 138.4	1 294.2	1 365.4	235.5	106.4	347.2	261.8	85.0	95.6	6.3
600-700. . . . .	698.3	96.8	—	—	354.6	430.5	306.6	75.8	28.1	111.5	82.1	24.7	32.4	6.5
700-800. . . . .	800.2	101.9	—	—	451.3	515.2	121.1	95.6	31.3	135.4	102.8	38.9	47.3	7.5
800-900. . . . .	901.4	101.2	—	—	575.9	557.5	377.0	133.4	34.4	155.3	120.4	68.2	64.2	9.5
900-1000. . . . .	1 000.6	99.2	—	—	551.0	459.2	693.4	151.3	57.9	120.1	106.7	67.1	47.9	9.3
1000-1100. . . . .	1 100.1	99.5	—	—	625.6	446.6	871.3	221.7	59.8	110.7	107.2	67.2	59.0	10.0
1100-1200. . . . .	1 200.9	100.8	—	—	739.8	490.5	871.5	330.1	39.3	135.3	125.5	57.3	52.3	11.2
From 12 to 24 months	—	599.4	—	—	3 298.2	2 899.5	3 240.9	1 007.9	259.8	768.3	644.7	323.4	303.1	9.0
Total to	1 200.9	1 089.2	460	1 659	4 436.6	4 193.7	4 606.3	1 243.4	357.2	1 115.5	912.5	408.4	398.7	7.8
Total to	1 302.5	1 190.8	460	1 659	5 271.1	4 979.7	5 630.7	1 395.1	508.9	1 419.0	1 140.1	408.4	398.7	1 200-1 300 14.4
Total to	1 400.6	1 288.9	460	1 659	6 124.4	5 749.3	6 846.3	1 553.2	659.5	1 730.2	1 371.0	408.4	401.2	1 300-1 400 15.2
Total to	1 500.0	1 388.3	460	1 659	7 030.2	6 309.7	8 582.7	1 759.5	760.1	2 072.4	1 592.4	408.4	436.5	1 400-1 500 15.4
														9.3

(1) Cost are based on the following feed-stuffs prices: Hay per lb. cents. 0.35 — Silage, 0.125 — Oil meal, 1.7 — Flour middlings, 1.3 — Bran, 1.2 — Corn, 0.9 — Barley, 1.1 — Oats, 1.2 — Milk, 1.3 — Skim milk, 0.25.

The cost of foodstuffs are compared with the prices realised on the Chicago market from 1905 to 1911, and it is shown that these prices are inadequate to cover the cost of production. For this reason many breeders have given up rearing beef cattle and entered the dairy industry. This has resulted in the infusion of dairy blood into many of the large herds of the United States.

TABLE II. — *Results from the lots of groups V and VI on pasture.*

Period	Weight (1)	Gain	Grain	Hay	Silage	Daily Grain	Daily Gain	Grain to 100 lbs.
—	—	—	—	—	—	—	—	—
Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs. Gain
700- 800	801.8	94.2	234.8	175.0	718.2	6.4	2.648	240
800- 900	904.5	102.7	324.7	207.0	1 106.0	7.1	2.276	318
900-1 000	997.6	93.1	423.3	254.4	1 395.1	8.1	1.780	456
1 000-1 100	1 092.8	95.2	513.8	340.7	1 282.6	9.2	1.699	541
1 100-1 200	1 204.4	111.6	582.7	254.5	1 309.7	10.4	1.994	522
Total 2nd. year	—	496.8	2 079.3	1 231.6	5 811.6	8.23	1.998	412
Total 1st. year	601.9	480.6	1 132.3	1 187.2	1 429.3	3.24	1.374	235

(1) Average weight on return from pasture 707.6 pounds.

The production of beef cattle is subject to two different factors: 1) the cost of meat must not be such as to cause a decrease in its consumption; 2) the breeder must make a profit which will enable him to keep in the trade.

The reforms necessary to gain these ends are:

1) The difference in prices paid for steers and the price of meat must be decreased.

2) The market must be stable, or else such great losses will be sustained by the producers that they will be obliged to give up the trade.

3) Experimental, demonstrational and educational work must be conducted along practical lines.

4) The methods of feeding and handling the steers must be made more economical in order to reduce the cost of production, for economical production and early marketing are as important factors in assuring profit in beef-production as a promising and stable market.

The data contained in the tables of this bulletin give useful information on this subject.

932 - **Experiments in Feeding for Beef in Canada.** — I. HUTTON, G. H. and FAIRFIELD, W. H., Feeding for Beef in Alberta; (Results of Experiments at Dominion Experimental Stations in Alberta from 1909 to 1915), in *Dominion of Canada Department of Agriculture, Experimental Farms Bulletin* No. 30, pp. 1-38. Ottawa, Ontario 1916. — II. MC. KILLICAN, W. C., Experiments in Steer Feeding in Manitoba (A Summary of Tests at the Experimental Farm, Brandon, Manitoba from 1892 to 1912), in *Dominion of Canada Department of Agriculture, Experimental Farms Bulletin* No. 13, pp. 1-24. Ottawa, 1916.

The results of the work done in feeding for beef on the Experimental



Stations in Alberta and Manitoba are set forth in these Bulletins with the purpose of furnishing farmers, interested in this problem, with data applying to conditions prevailing in these Provinces. The importance of finishing beef is emphasized, as the results indicate that operating under average farm conditions the selling of half-finished animals fails to realize the largest possible profits. In the southeastern limits of the province of Alberta, however, where young stock can be advantageously produced, natural conditions are such that the growing of finishing feeds is inadvisable. Stock growers in these districts should sell their grown but unfinished steers to the farmer in the districts better suited to grain or alfalfa growing, to be finished finally for market.

The results also indicate that the necessary initial investment to provide suitable forms of shelter is relatively small. The financing of such undertakings as far as the purchase of steers is concerned, is facilitated by the banks, which view such investments with much more favour than formerly.

I. — The following deductions were made at Lacombe Station, Alberta:

1) Three-year-old steers seem better adapted to straight wheat feeding than are two-year-old steers.

2) From the results of the six years' work it is evident that low-grade grains may be made to bring the producer a higher price per bushel sold through steers than will high-grade grains sold through the elevators.

3) Hay, green feed, and straw may be profitably fed at home.

4) From experimental work conducted with grain plots at Lacombe Station, a valuation of the manure produced through feeding cattle, at \$1 per ton applied is warranted. The fertile soil of the western prairies will not retain its fertility indefinitely without a return of at least a portion of the constituents drawn from it in the production of crops.

5) It is not necessary to provide an elaborate equipment in order to be able to undertake the satisfactory feeding of steers for the production of beef in this climate.

6) From the figures submitted it would appear wise for the breeder to be a feeder also and market his product in finished condition.

7) The increased demand and higher price paid for beef cattle in the autumn has resulted in higher prices for stockers. It is not likely that as wide a spread will obtain in future between stocker cattle in the autumn and beef cattle in the spring, as was the case during the early years of experimental feeding.

8) That the purchase of stocker cattle in the spring to make use of otherwise waste pasture is likely to prove a profitable undertaking.

The results of the Lethbridge Station, Alberta, showed that, charging the alfalfa fed in the tests \$12 per ton, a net profit has been shown each year. The average gain per day per animal was not great during the last winter on account of the light grain ration adopted, in view of the fact that the average farmer has an excess of alfalfa as compared to the quantity of grain for feeding purposes.

In the first winter the average daily grain ration was 8.3 lbs. and the daily gain was 1.77 lbs. In the second winter the average grain



fed was 7.4 lbs. per day and the gain was 1.55 lbs. per day. In the third winter the average grain fed was 5.7 lbs. per day and the average gain was only 0.96 lbs. per day. Judging from these tests it would seem that it would not pay the farmer to feed less than 6 lbs. per day for the entire feeding period, and if at all possible he should arrange to feed an average of between 8 and 9 lbs. The steers should be started with a very small allowance, say 2 lbs. a day, and kept at this amount till all become accustomed to eating it, then increased gradually. For the last three or four weeks of the feeding period they should be increased to 12 or 14 pounds daily. Hay of the best quality should be reserved to feed during this period.

II. — The most important conclusions from the experiments conducted at the Brandon Experimental Farm, Manitoba, may be briefly expressed as follows:

- 1) Steer feeding may be profitably carried on in Manitoba.
- 2) Good results can be obtained with no other feeds than straw and grain.
- 3) The addition of succulent feed such as roots or ensilage improves a ration.
- 4) Hay and oat sheaves are very useful and give larger gains than straw.
- 5) Alfalfa and corn are especially valuable on account of their feeding value combined with large yields.
- 6) Between two and three years appears to be the best age at which to fatten.
- 7) Only steers of good beef type should be used.
- 8) There should be a margin of at least  $1 \frac{1}{4}$  cents per lb. between buying and selling prices in order to make a profit.
- 9) Steers fed loose in a box stall do better than when tied.
- 10) Dehorning gives little or no setback and makes loose feeding practicable.
- 11) Steers may be fattened successfully outdoors in winter in Manitoba if sheltered from the wind.
- 12) Steers fed in a stable will make greater gains than when fed outdoors, but probably not sufficient to pay for an expensive stable.
- 13) Coarse grains, whether oats, barley or low-grade wheat, can be marketed more profitably through steers than through the elevator.
- 14) The farmer who raises a good steer and sells him thin or half-finished usually loses the best part of the profit.

933 - **The By-Products of the Decortication of Rice ("pula vergine") in the Feeding of Working Oxen; Experiments in Italy.** — PIROCCHI, ANTONIO, in *La Clinica veterinaria*, Year 30, No. 14-15, pp. 428-442. Milan, July 30-August 15, 1917.

This paper deals with experiments carried out in connection with the Army Veterinary Corps at Milan at the Zootechnical Institute of the Milan Royal High School of Agriculture, because of the good results obtained

by Prof. RENZO GIULIANI in the use of the by-products of the decoration of rice for feeding dairy cows (1).

The experiments were undertaken to determine :

- 1) The average amount of hay to be replaced by 1 lb. of these by-products in the ration of draught oxen ;
- 2) The methods of preserving and distributing this food ;
- 3) Its influence on the health, weight and working capacity of the experimental animals ;
- 4) The economic advantages to be gained by using these by-products in the place of hay.

Twenty draught-oxen of the Schwyz, Podolia, Dutch, Brescia and Bergamo breeds, were used for the experiment.

During the preparatory period of 15 days (from the 15th. to the 26th. November, 1916) the following ration was given : 37 ½ lbs. of alfalfa hay and clover mixed in the ratio of 9 : 1 respectively and 4 ¼ lbs. of good quality wheat straw. The composition of this ration is shown in Table I.

TABLE I. — *Composition of the ration given during the preparatory period.*

	Total dry matter	Digestible substances						Total Nitrogen-free extract + fibre
		Albumin	Starch	Crude protein	Fat	Nitrogen-free extract	Fibre	
	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.
Hay 37 ½ lbs.	30.236	1.801	11.996	2.560	0.266	9.708	5.143	14.852
Straw 4 ¼ lbs.	3.550	—	0.475	0.017	0.017	0.585	0.897	1.482
<i>Total</i>	<b>33.786</b>	<b>1.801</b>	<b>12.471</b>	<b>2.577</b>	<b>0.283</b>	<b>10.293</b>	<b>6.040</b>	<b>16.334</b>

The "pula vergine" used in the experiment was guaranteed to contain a total of 24 % nitrogen and fat ; it was free from the awns and small flakes of ground bran which are found in more or less large quantities in all other qualities of "pula vergine".

In order to ascertain the quantity of hay to be replaced by 1 lb. of "pula vergine", the two foods were analysed and their starch values determined. The results are given in Table II.

TABLE II. — *Chemical composition and starch value of hay and "pula vergine".*

<i>Composition per cent :</i>	Hay	"Pula vergine"
Moisture . . . . .	19.15	15.60
Ash . . . . .	6.36	10.15
Crude protein . . . . .	9.20	11.55
Crude fat . . . . .	1.42	13.60
Fibre . . . . .	23.31	9.00
Nitrogen-free extract . . . . .	40.56	40.50
Digestible protein . . . . .	6.85	8.90

(1) See R., January 1917, No. 56 ; R. August 1917, No. 739.

(Ed.).

*Starch value of 100 lbs.:*

Digestible albumin . . . . .	4.82 % × 0.94 =	4.530	7.85 × 0.94 =	7.379
Digestible fat . . . . .	0.714 » × 1.91 =	1.363	11.56 × 2.12 =	24.507
Digestible nitrogen-free extract	25.958 » × 1 =	25.958	32.08 × 1 =	32.080
Digestible fibre . . . . .	13.752 » × 1 =	13.752	1.35 × 1 =	1.350
	<i>Total</i>	<b>45.603</b>		<b>65.316</b>
Deduct :				
23.31 % of total crude fibre × 0.58		13.519		
	<i>Actual Starch value</i>	<b>32.084</b>		<b>65.316</b>

1 lb. of *full food value* "pula vergine", therefore, replaces 65.316 : 32.084 = 2.035 lbs. of hay, or, in round figures, twice its weight.

From the 30th. November to the 2nd, December, up to 6½ lbs. of hay were gradually replaced by half its weight of "pula vergine"; from the 2nd. December 1916 to the 3rd. January 1917, 30 lbs. of hay + 3¼ lbs. of "pula" + 4½ lbs. of wheat straw, were given, and from the 4th. January to the 3rd. February; 28½ lbs. of hay + 4½ lbs. of "pula" + 4½ lbs. of wheat straw, per head per day.

The oxen immediately ate the "pula" greedily, and no trouble was noted in the state of their health. Their weight varied slightly in both directions; on the whole they showed, during the experimental period properly speaking, a slight increase of 102 lbs. The inclusion of "pula" in the ration has no detrimental influence on the working capacity.

With the present price of 5s. 8d. per cwt. fixed for "pula vergine" by the decree of the 12th. November, 1916, by the Home Office and Department of Agriculture, and of 4s. 8d. per cwt. for hay (requisition price), if 1 cwt. of "pula" is given in place of 2 cwt. of hay, there is a saving of 9s. 4d. - 5s. 8d. = 3s. 8d.

The author points out that, contrary to Prof. GIULIANI's experience with dairy cows, none of the oxen fed with "pula" suffered from coughing. This is probably due to the fact that, in the latter case, the "pula" used was completely free from awns and scales, whereas the cows had been fed with 1st. and 2nd. quality "pula" containing "tondello" and "fumetto" (1) with minute scales and awns, which, lodging in the mucous membrane, had probably caused fits of coughing.

(1) The preparation of rice includes the following principal operations:

1) screening; 2) hulling; 3) milling; 4) polishing. The first operation, carried out with fans, etc., frees the paddy from dust and foreign matter. The second frees the rice from the glumes or hulls, by means of a huller. The third operation removes the bran coat; for this purpose either a bran reel or a pearling cone is used, and the rice passed through it 3 or 4 times, being sifted and fanned between each process. The product thus obtained is the commercial rice. The fourth operation subjects the commercial rice to long and gentle polishing by mixing it, drop by drop, with fine, colourless oil. This gives "camolino" rice, or, if the process is continued and special ingredients used (glucose, talc, etc.), polished rice. The by-products obtained from the preparation of rice are: 1) "lolla" or "pulone" (large hulls), and their derivatives, "ruschetta", "tondello" and "fumetto"; 2) "mezza grana"; 3) "risina" or "pistino"; 4) "pula". "Lolla" consist entirely of the glumes of the cereal;



## POULTRY

934 - **Fertility and Age in the Domestic Fowl.** — PEARL, RAYMOND, in the *Proceedings of the National Academy of Sciences of the United States of America*, Vol. 3, No. 5, pp. 351-356. Washington, D. C., May, 1917.

MARSHALL (1), PEARL (2) and KING (3) have already shown that in a large number of different mammals fertility varies in a definite way with the age of the animal. Low at the beginning of sexual life, fertility increases till a maximum is reached, when it begins to decrease till, at a certain age, total sterility is attained. MARSHALL considered the domestic fowl showed the same sort of change, basing his opinion on statistics which the author proved to be inadequate. Recently the author has again studied this question, on the basis of 1114 matings of Barred Plymouth Rock fowls, during a period of 9 years.

The author defines fertility as the total net reproductive capacity of pairs of organisms, male and female, as indicated by their ability to produce viable offspring. To measure this he used an index *RI* which represents the percentage of viable offspring produced from a particular mating as compared with the maximum number physiologically possible during the time the mating lasts. With this he drew up the formula

$$RI = 100 C : Em$$

in which *C* is the number of chickens produced from a mating and alive at the end of the third week after hatching, and *Em* the total number of days from the day when the mating started till the day when the last egg began its incubation.

This index would be 100 % i. e., maximum fecundity would be attained, if, during mating, the hen laid one egg each day, if each of these eggs were fertile, and if each embryo hatched and lived three weeks.

The following results were obtained :

*Weighted average reproductive indices for males of specified ages mated with females of all ages.*

Age	Average RI.
Male, 1 year . . . . .	12.868
" 2 years . . . . .	10.214
" 3 years . . . . .	0.625

when coarsely milled, this becomes "ruschetta". This product, after being crushed till it is softer and less easily recognisable, is used chiefly to adulterate wheat bran. By finer milling and passage through a double sieve, "lolla", "tondello" and "fumetto" are obtained. The first of these resembles a fine bran and appears to be formed of minute scales mixed with small awns; the second, on the contrary, is like flour. "Fumetto" always contains a certain amount of mineral dust. "Fumetto" and "tondello" are mixed with the "pula". The "mezza grana" is composed of small or broken grain; the "risina" or "pistino" of fragments of grain. "Pula" is the residu left from the successive passages of the rice through the reel or pearling cone at the expense of the tegument and the germ of the rice grains. (Dr. RENZO GIULIANI, *Esperienze sull'uso della pula di riso come alimento delle vacche da latte. La Clinica Veterinaria*, Year XI, No. 13, pp. 384-392 and No. 14-15, pp. 403-427. Milan, July 15 and July 30-August 15, 1917.) (Ed.).

(1) MARSHALL, F. N. A., *The Physiology of Reproduction*. London, 1910. (Author).

(2) PEARL, R., *Science*, New York, N. S., Vol. 37, pp. 226-228, 1913. (Author).

(3) KING, H. D., *Anat. Record*, Philadelphia, Vol. II, pp. 269-289, 1916. (Author).

*Weighted average reproductive indices for females of specified ages mated with males of all ages.*

Age	Average R. I.
Female, 1 year . . . . .	12.765
" 2 years . . . . .	11.660
" 3 years . . . . .	10.722

These figures show that fertility, as measured by the index, decreases with advancing age in both sexes, but more rapidly in the male than in the female.

*Weighted average reproductive indices for matings of individuals of specified combined ages.*

Combined ages of individuals when mated	Cases	Average R. I.
2 years . . . . .	796	13.083
3 " . . . . .	190	11.121
4 " . . . . .	113	11.119
5 " . . . . .	12	7.458

After a combined age of 4 years the cases were too few to give definite results. Up to that age the figures show a great drop in reproductive ability when passing from a combined age of two years to one of three years, that, in passing from three to four years, there is little change, but that there is another large drop when passing from a combined age of four years to one of five years.

These results show that the law of fertility which has been found to hold for mammals does not apply to fowls, which show a steady and progressive decline in fertility after the first breeding season.

935 - **The Feeding of Poultry.** — *The Journal of the Board of Agriculture*, Vol. XXIV, No. 2, pp. 189-190. London, May, 1917.

In view of the necessity of reserving as much grain as possible for human consumption it is necessary to ascertain whether poultry keeping increases or decreases the national food supply. In order to solve this question the President of the Board of Agriculture calls the attention of poultry-keepers to the following facts.

On an average, an 18 months old pullet has eaten 100 lbs. corn and meal, or their equivalent in other foodstuffs, it has laid 180 eggs, and, when killed, weighs, about 4  $\frac{1}{2}$  lbs. The dry edible human food contained in its carcass and in the eggs it has laid is about 6  $\frac{1}{2}$  lbs., so that it has eaten about 15 lbs. of corn and meal, or their equivalent, per 1 lb. of human foodstuff produced. Therefore, if the grain and meal eaten by the hen are fit for human food, poultry-keeping reduces the national food supply. On the other hand, if the pullet is fed on scraps, waste, tail corn, or other materials unfit for human consumption, the national food supply is increased.

If this test be applied to other animals, the pig is found to be a more economical source of food. The following suggestions are, therefore, made to poultry-keepers.



1) Poultry should be kept in small numbers only, so that they may be fed exclusively on scraps or other material unfit for human food.

2) When the quantity of such food available is sufficient to keep a pig, the pig should be preferred to poultry.

3) At the end of the laying season the number of hens kept should be reduced, and the number of poultry kept for fattening restricted to the amount of material unfit for human consumption available for feeding them.

## SERICULTURE

936 - **Parthenogenesis in the Silkworm** (1). — Lecaillon, A., in *Comptes Rendus des Séances de l'Académie des Sciences*, Vol. 165, No. 5, pp. 192-194. Paris, July 30, 1917.

In 1916 and 1917 the author continued the studies, undertaken in 1914 and 1915, on the importance of the change in colour which occurs normally in certain unfertilised eggs of *Bombyx mori*, and on the formation, in this species, of larvae of parthenogenetic origin.

The unfertilised eggs used were taken from 130 females of the same univoltine breed as those of the previous experiments. There were about 26 000 eggs in all, each moth laying an average of 200.

The results were as follows:

a) After remaining pale yellow for some days, like fertilised eggs, the unfertilised eggs break up into two groups: 1) those which undergo incomplete and abnormal segmentation, which keep their colour and degenerate, and 2) those which continue to develop and become either completely or partly pink or reddish, according to the degree of development reached.

b) The eggs of the 2nd. group again subdivide into two groups: 1) those which degenerate, and 2) those which continue to develop.

c) These, in their turn, become slate grey; 1) some degenerate and 2) others give rise to larvae which may be seen if the eggs are opened.

d) Finally, these last again subdivide into two groups: 1) those whose larvae die in the egg, and 2) those which hatch and give living larvae.

In his experiments the author noticed that numerous larvae died in the egg, in many cases 12 to 20 of the total number laid.

Eight live larvae were obtained from a total number of 20 eggs laid at one time; of these eight, four were bred without difficulty.

The preservation of unfertilised eggs is more difficult than that of fertilised eggs. By improving the methods of preservation it would, presumably, be possible to obtain a larger number of larvae adapted to normal life.

937 - **The Best Silkworm Hybrids of the First Generation.** — *Bulletin de l'Association séricicole du Japon* (abstract from the *Bulletin de l'Institut National de Sériciculture*), Year 2, No. 10, pp. 4-5. Tokyo, May 1st. 1917.

This bulletin asserts, without giving any reason why, that the hybrids of the first generation are really strong.

The following table, compiled from the results of many experiments, shows which are the best hybrids.

(1) See R., 1916, No. 427.



Variety	Duration of breeding		Mortality during breeding	Proportion of double cocoons	Length of thread	Richness in silk	Standard
	days	hours	per cent.	per cent.	turns of reel	gr.	denari (1)
Sino-Japanese hybrids . .	20	8	13.4	12.0	639.7	0.2288	3.01
Japano-European hybrids .	31	11	12.2	7.5	644.1	0.2576	3.20
Sino-European hybrids . .	29	17	12.2	4.8	726.1	0.2612	2.90
Japano-Japanese hybrids .	31	21	12.2	10.3	561.3	0.2096	3.00
Sino-Chinese hybrids . .	29	9	14.7	7.3	637.9	0.2176	2.74
Europo-European hybrids .	31	0	13.6	1.8	729.1	0.2585	2.83
Original breeds from Japan.	32	6	20.9	8.9	541.6	0.2044	3.02
"    "    "    China.	29	9	18.4	5.0	619.0	0.2011	2.65
"    "    "    Europe	32	5	22.1	2.4	719.4	0.2435	2.74

The breeding of the hybrids of the first generation is usually shorter than that of all, or nearly all, the original breeds. In this respect there is very little difference between the hybrids of the first Sino-Japanese and Sino-European hybrids and the original Chinese breeds, but when compared with other breeds, the time required is perceptibly shorter.

The mortality during breeding is rather less (from 10 to 15 %) for the hybrids of the first generation than for all the original breeds.

The proportion of double cocoons is rather larger (except for the Euro-European) in the hybrids of the first generation than in all the original breeds. It is highest in the Sino-Japanese hybrids.

The thread is longer in hybrids of the first generation than in all the original breeds.

The silk from hybrids of the first generation seems much richer and usually firmer than that of the original breeds. There is very little difference in the quality of the silk of Sino-Japanese and Japano-European hybrids and that of the original Japanese breeds. In the Sino-European hybrids the quality is slightly higher than that of the European breeds only, whereas that of the Japano-Japanese, Sino-Chinese and Euro-European hybrids differs but very slightly from that of the original breeds.

Some of the hybrids of the first generation when crossed show variations, but these are only very slight.

The Sino-European hybrids of the first generation give the best results from every point of view. The Sino-Japanese are inferior to them but, where white cocoons are concerned, are usually superior to the native breeds.

- 938 - **The Biology of the Spawning Migration of Shad (*Alosa* spp.)** — ROULE, LOUIS, in *Comptes rendus des Séances de la Société de Biologie*, Vol. LXXX, No. 15, pp. 705-706. Paris, July 28, 1917.

Commenting on Prof. BOUNHIOL's paper on the spawning migration of *Alosa finta* Cuv. of the Algerian Coast (1), the author states that many observations made during the course of his studies show that, also in the case of French river shad (*Alosa alosa* L. and *A. finta* Cuv.) the spawning migration seems to be determined by a respiratory tropism; owing to their respiratory needs the fish go where the oxygen content is highest.

If, on the whole, this determinism is in agreement with that of other river spawnners, yet it differs from it in many details to which the author draws attention.

- 939 - **Carajat Incubator for Hatching Trout Fry.** — GÉRDIL, H., in *La Vie agricole et rurale*, Year 7, No. 35. pp. 151-154. Paris, September 1, 1917.

The author describes an incubator, called "*Le Pisciculteur*", invented by M. CARAJAT, and gives an account of the excellent results which have been obtained with it.

The apparatus consists of small hexagonal tubes, 30 to 40 mm. long, joined together in groups of 500 or 1000. Each of these tubes has a diameter of 6 mm., just a convenient size for taking one trout egg. The tube is open at both ends.

The group of similar small tubes or cells forms a frame resembling a honeycomb. These frames are made of varnished cardboard, a light, inexpensive, resistant material which does not lose its shape in water.

Two opposite walls of the hexagonal cell curve out so as to form two buttresses, which partially close the cell, by dividing it into two unequal cavities communicating one with the other. One of these cavities is 7 mm. high, and the other, which occupies the rest of the cell, 28 to 30 mm. high.

To fill the incubator the frame is placed flat with the cavities on top, and the eggs spread over the surface. One egg falls into each cell.

The two sides of the frame are then closed by means of a brass net with apertures of about 1 mm. These nets are fixed on to the frame with 6 metal catches.

As the eggs are in the small cavities near the net they can be watched during incubation.

The incubator may be put into any water so long as it is ventilated. It should be placed edgeways, facing the current, if there is any. If the current is too strong the incubator must be protected by wicker-work, or some other arrangement for modifying the speed of the water.

When the apparatus is immersed, care must be taken to ascertain that no air-bubbles are left and that the eggs are well in the water. As the eggs are separated there is no danger of contamination.

The fry may be kept in the cells and thus protected from their enemies till they have reabsorbed their umbilical vesicle. In this case the eggs are

(1) See R., August, 1917, No. 751.

(Ed.)

put in the large cavities and it is not necessary to put the net over the side corresponding to the small cavities; the narrow division is sufficient to preserve the egg, but, after hatching, it allows the fry to escape into the open water.

M. CARAJAT's incubator has been tested in various parts of France under the most diverse conditions, and has always given excellent results. The yield obtained varied between 93 and 99 %.

## FARM ENGINEERING.

940 -- **Machine Cultivation Trials at Mettray, France.** — SAGNIER, HENRI, in *Journal d'Agriculture pratique*, Year 81, No. 15, pp. 283-285. Paris, July 26, 1917.

AGRICULTURAL  
MACHINERY  
AND  
IMPLEMENTS

According to the Ministerial decree, the Trials at Mettray (Indre-et-Loire) were solely to concern machines for cultivation of vines and plants in lines.

Nine machines were entered, but only two took part in the trials, the small 10 H. P. Avery from the firm of PILTER of Paris, and the 12 H. P. Misvalley from Messrs. JOUHER and BLAIN-MISTAL of Paris, machines already noticed at previous trials.

The chief difficulty in cultivating vines by tractors lies in the distance between the lines: their breadth requires a fair width; in vines planted close together they are either unable to enter, or they damage the branches and fruits.

At Mettray, the two tractors could only cultivate when a breadth of 6 feet was available between the vines. In this case, the Misvalley tractor towed a 9-tine cultivator 173 yards in 5 minutes, while the small Avery towed a 12 spring-tine harrow the same distance in 4 minutes. For both machines, turning at the end of the line required 30 seconds.

Trials with plants in lines were carried out on hoeing mangels, potatoes, beans, and maize (for forage).

The mangel field was 379 yards long, the distance between the rows being 28 ins. The Misvalley, towing a MASSEY-HARRIS 6-tine cultivator working 2 rows at once, crossed the field in 14 minutes; the Avery with 2 PLANET hoes required 13 min. 20 secs. For both machines turning required 30 seconds.

The potato field was 49 yards long, with an 8 % slope; the distance between the rows was 31 ins. Misvalley ascended the whole slope in 2 min. 15 secs., descending in 2 minutes; the small Avery went up in from 2 mins. 41 secs. to 2 mins. 48 secs., descending in 2 min. 10 secs. to 2 mins. 15 secs. The time occupied by turning was 15 secs. for the former and 12 for the latter.

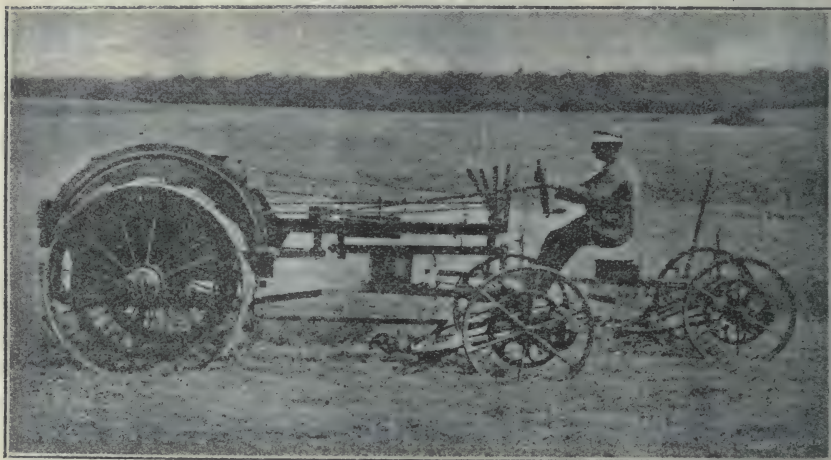
The bean field was 130 yards long, with a 20 % slope over a length of 22 yards; the rows were 29 inches apart. Misvalley required 4 min. 15 secs. to 4 min. 59 secs to mount the slope, descending in 3 min. 8 secs, while turning required 24 secs. The small Avery mounted in 5 min. 30 secs., coming down in 5 mins., and turning in 30 seconds.



During these trials the General Agricultural Committee and the Wine-growers' Association of Indre-et-Loire organised trials for special vineyard-hoes, three machines taking part. Machines are wanted which will cultivate between the vines economically and automatically; it seems a difficult aim, as the vine must not be damaged. The vineyard-hoes were towed by tractors, which moved forward only slowly.

941 - **The Moline Farm Tractor.** — I. *Il Giornale di Risicoltura*, Year 7, No. 10, pp. 133-136, 2 fig. Vercelli, May 30, 1917. — II, *Engineering*, Vol. CIV, No. 2692, p. 131, 1 fig. London, August 3, 1917.

The MOLINE tractor is designed so that it can either serve as a tractor or as a motorplough, motorharvester, etc., the latter combinations being obtained by changing the back wheels.



MOLINE Farm Tractor.

The tractor has two driving wheels in front (diameter 51 ins., with 9 in. tyres), fitted with strakes to give a grip on the ground. One of these wheels may be adjusted so that it can run in the furrow and yet maintain the machine horizontal.

The tractor has 2 opposed horizontal cylinders, giving 10 to 12 H.P. on the belt. It drives through gearing and a differential; there is one speed forward and one reverse. The gear box is placed with the differentials between the driving wheels.

The driver always rides on the implement and not on the tractor, having all the controls of both motor and implements ready to hand. The high-tension magneto, the radiator with fan, the petrol tank, etc., are all grouped between the 2 driving wheels.

Set up as a tractor with the two back-wheels (diameter 23 ins., width 3 ins.) the machine weighs 25 cwt; the overall width is 4 ft. 6 ins. Used as a

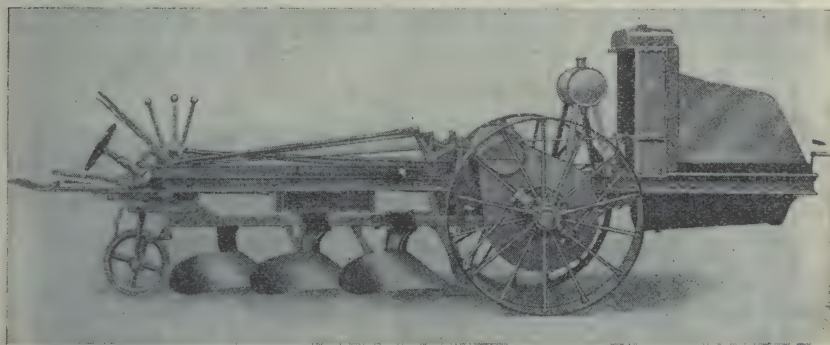
plough, 2 "Moline" plough bodies are provided. It is easily controlled and works a depth of 10 ins.

This tractor is at present being tested at the Experimental Station for Ricegrowing at Vercelli, Italy.

942 - **The Crawley Agrimotor.** — *The Implement and Machinery Review*, Vol. 43, No 508 pp. 391-392, fig. 2. London. August 1, 1917.

This motor plough (1) is easily converted into a tractor for pulling a cultivator, binder, mower, or other agricultural machine.

It is driven by a four-cylinder vertical petrol engine capable of developing 30 b. h. p. at 900 revolutions per minute. The top half of the crank case carries the whole of the mechanism of the engine, whilst the bottom half constitutes an oil well. Electric ignition is provided by a



CRAWLEY Agrimotor.

high-tension Dixie magneto of a new type. Two speeds forward and a reverse are provided. Gear drive is employed throughout, no chains being used. The main gear wheels, which are of a cast-steel alloy, are bolted to the travelling wheel hubs and driven by hardened steel pinions sliding on castellated shafts, thus giving an independent drive to either travelling wheel.

Steering is effected by means of a hand wheel operating a rack and pinion, the patent locking-steering gear employed making the machine self-steering on the straight, whilst the turning is accomplished by engine power. All the operating levers are conveniently arranged in a compact cast steel gate fixed at the rear of the machine, and within easy reach of the driver's seat.

(1) The following is extracted from "Notes de Culture Mécanique": Weight 3582 lb. Length 16 feet 3 inches, breadth 6 feet 1 inch, height 5 feet 3 inches. Travelling wheels: breadth 8 inches, diameter 4 feet; rear wheel: 3 inches, diameter 1 foot. Price: £346 19s. 4d. Has been shown at Chelmsford and Cambridge (1915). DR. CHAUVÉAU, *Notes de Culture Mécanique*, published by Baillière, Paris, 1917. (Ed.)



It is claimed that with this agrimotor an acre of average land can be ploughed in 2 hours on a petrol consumption of 2 gallons, and the width of the furrow can be altered as desired.

This machine is made by the Crawley Agrimotor Co., Saffron Walden, Essex.

943 - **The Schlenker Motorplough.** — *Wiener Landwirtschaftliche Zeitung*, Year 67, Nos. 60 and 61, pp. 427 and 435, 3 figs. Vienna, July 28 and August 1, 1917.

The new motorplough invented by an Austrian, Dr. SCHLENKER of Linz, and tested on June 9, 1917 before the Royal Agricultural Society of Austria, presents a quite new system.

The motorplough can also be used as a tractor for agricultural machines and waggons or for driving a thresher.



SCHLENKER Motorplough.

Its chief points are :

Weight 26 cwt ; very powerful ; length - 15 ft., height - 5 ft ; working depth can be adjusted, even during work, while the plough bodies are lifted up by means of the engine ; angle of work adjustable ; plough bodies displaceable forwards, laterally, or to the rear ; engine has a reverse ; engine completely under control ; sudden stops possible ; only one person required to control the machine ; turns in a small area ; simple construction ; a single driving wheel placed in front of the plough ; easily convertible to other agricultural uses, etc.

The Schlenker motorplough, reproduced in the above figure, is built by the " Motor - und Motorpfluggesellschaft " of Linz, Austria.

944 - **Patent Stone, Sand and Asphalt Distributing Machines.** — *Engineering News-Record*, Vol. 79, No. 4, pp. 191-192. New-York, July 26, 1917.

To reduce to a minimum the labour required for road construction, A. JOHNSON, division engineer of the Massachusetts State Highway Commission, has patented a mechanical stone and gravel spreader, to work in combination with a bitumen - spraying truck.



In construction and operation the new machine is exactly similar to the manure spreader in general use, indeed, experiments with a manure spreader for spreading small stones suggested the use of the stronger machine described.

945 - **Simultaneous Harvesting and Breaking-up of Stubble with a Tractor.** — RINGELMANN, M., in *Bulletin de la Société d'Encouragement pour l'Industrie Nationale*, Vol. 127, No. 3, pp. 504-599, 2 fig. Paris, May-June, 1917.

To carry out harvesting and breaking-up of stubble simultaneously with a tractor, the harvester may be placed either in front or behind of the cultivator ; in the first case, the cultivator should be placed on the side opposite to that of the harvester ; in the second, it can be attached in the mid-line.

The writer assumes that the harvester-binder has a knife blade either 6 or 7 ft. long, and that the cultivator is either 6 ft. wide with 13 tines or 7 1/2 ft. wide with 17 tines. A knife blade 5 ft. long may be used. Fig. 1 shows the arrangement of a cultivator and a harvester-binder both coupled to a draw-bar *cd* drawn at *r* by the tractor *t*; the cultivator *C* may be attached at *b* while the harvester *M* cutting the crop *R* is attached at *a*.

A space  $b$  is left between the wheel of the cultivator  $C$  and the pole  $a$  of the harvester of at least 20 inches, so that the minimum length  $ef$  is equal to half the width  $d$  of the cultivator plus 20 ins. For a 13-tine cultivator (69 ins broad and 83 ins. away from the tyres of the wheels), the length of  $ef$  would be 61 to 63 ins. With the arrangement in fig. 1, the pole  $a$  is sufficiently long, and turning to the left at the headland would be awkward were a greater radius required.

When coupling the tractor at  $b$  and placing the pole  $a$  of the binder  $M$  in the line of traction of the cultivator  $C$ , there is danger, given the dimension  $d$  of the machines, that the knife-blade would have to be reduced too much.

On the other hand, coupling the binder to the cultivator-frame is difficult, because the tines have to be lifted for turning.

Fig. 2 shows a plan for coupling a harvester binder and cultivator to a binder. However, as the binder-frame is not designed for transmitting the tractive effort, it must be strengthened by special parts consisting of

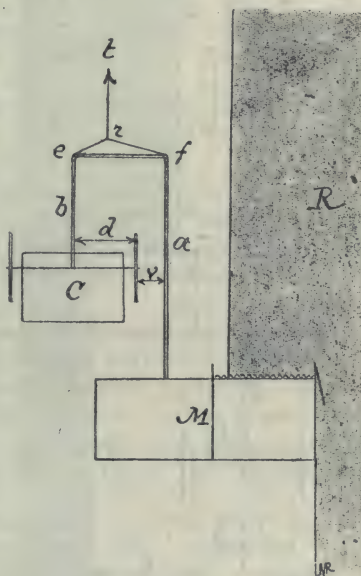


Fig. 1. — Plan for coupling  
a cultivator and a harvester-binder  
to a tractor.

iron bars held by stirrups and so designed as to cause the driving-wheel of the harvester to grip the ground.

In fig. 2, the harvester-binder  $M$ , harvesting the cereal  $R$  in the space between  $y$  and  $y'$ , is coupled by  $a$  to the tractor  $T$  proceeding in the direction of the arrow  $f$ . The cultivator  $C$ , coupled by  $b$  and placed in the mid-line along  $a$  works in the space  $y'' - y'''$ , leaving a distance  $l$  between  $y''$  and  $y'$  for the passage of the tractor  $T$  on the following turn; the sheaves should be discharged outside the point  $y'''$  of the cultivator. The knife bar of the reaper can begin to cut at a distance  $u$  of about 32 to 35 ins from the mid-line  $a$ . In working, some 8 to 12 inches of the knife blade are not used; so that, in reality, a binder with a 71 inch knife bar only cuts a width of 59 to 63 ins. Again, an 81 inch knife bar only cuts a width of 61 to 75 ins.

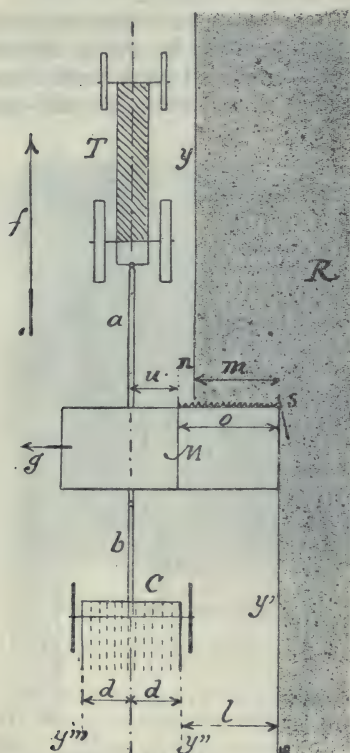


Fig. 2. — Plan for coupling a harvester-binder and a cultivator to a tractor.

If the frame of the harvester-binder cannot be strengthened between  $a$  and  $b$ , the cultivator-coupling  $b$  should be moved a little to the left, thus increasing the width  $l$ ; in this way compensation is made for the resistance caused by the dividing wheel  $S$  of the harvester, but it should be seen that the cultivator does not foul the sheaves.

In calculating the total average traction of a harvester binder according to the formula :

$$t = r + k Pm,$$

where  $t$  equals the average resistance,  $r$  the road (not working) resistance, which is an average of 374 lb. for a 60 in. machine and 418 lb. for an 81 inch machine, and allowing 10 % variation for the figures quoted,

$k$  = an experimental coefficient, which is on

the average 62, with 4 % variation according to the type of machine,

$P$  = the weight of the crop in lbs. per sq. ft.

$m$  = the length of the knife bar actually used.

an average total resistance of 561 to 574 lbs. is obtained for machines having a 61 in. knife-bar, and 642 to 656 lbs. for machines with an 81 in. knife bar, the figures referring to heavy crops of wheat (33.3 imp. bush. per acre) with a total weight of 20240 lbs., that is  $P = 0.19$  lbs. per sq. yd.



A cultivator with 13 spring tines working on dry stubble, at 2 to 3 ins. deep, requires a tractive effort of 99 lbs., a 17 tine cultivator requiring a pull of 1298 lbs.

Adding these figures to those for the harvester-binder, we get the average total tractive effort required from the tractors under the above conditions.

*Table showing the average total tractive effort required from the tractor.*

Harvester-binder, length of knife bar . . . . .	71 ins.	82 ins.		
Cultivator . . . . .	number of tines . . . . .	13	17	
	width of work . . . . .	69 ins.	91 ins.	
Working length of knife bar . . . . .	59 ins.	63 ins.	71 ins.	75 ins.
Average tractive effort	of harvester binder.. . . .	561 lbs.	574 lbs.	642 lbs.
	of cultivator . . . . .	999 "	999 "	1309 "
Total . . . . .	1550 lbs.	1574 lbs.	1951 lbs.	1965 lbs.

In the first case (1550 lbs.) with a speed of 43 ins. per second (about 2.5 miles per hour) the average power of 10 H. P. is required from the tractor, which means the engine will develop about 20 H. P.

At the same speed (2.5 miles per hour), the last case (1965 lbs)\* requires 13 H. P. from an engine developing 26 H. P. With the reserve power required for slopes, etc., the writer thinks that the knife-bars should not exceed 71 in., while the cultivators should not have more than 13 tines (69 ins.) so as to use 25 H. P. tractors.

With 20 H. P. tractors, a harvester-binder with a 59 inch bar may be used, the cultivator going twice over certain parts of the work.

Ploughing up stubble immediately after harvesting has the advantage of diminishing soil drainage while the slightest rain has a useful effect on nitrification. As disadvantage, carting the sheaves is more difficult, a slight thing, however, when the advantage is taken into consideration.

946 - **Clover Seed Stripper.** — *United States Department of Agriculture Weekly News Letter*, Vol. IV, No. 41, p. 4. Washington D. C., May 16, 1917.

A homemade device for gathering crimson clover seed, which the farmer may make and use with a small outlay of time and money, is described in *Farmers' Bulletin* No 646. The handicaps under which crimson clover seed production in the United States have laboured have necessitated the importation of from 3 to 5 million pounds of seed annually. The farmer on the ordinary farm may make arrangements to save his own seed for reseeded purposes by the use of this simple device, which is made as follows :

The stripper is designed to be hung on the axle A between two wheels, which, however, are not shown in the drawing. The iron hooks G are used for attaching the stripper to the axle. The hook G should be of such length as to allow the bottom of the stripper to miss the ground by 6 inches. The handle M permits the teeth to be raised or lowered to catch the heads at the proper height. The limits through which teeth may be raised or lowered are fixed by means of the slot T. This prevent either the front



or back of the machine tilting enough to strike the ground. When it is desired to hold the stripper rigid the removable bolt *C* can be taken out and inserted in one of the holes *E*. Bolt *D* should fit loosely in the bottom of board *B* to permit easy action of the attachment. It is necessary to have the plank *N* to which the whiffletree is attached fastened to the shafts far enough in front of the teeth to prevent the horse's hoofs from coming in contact with the teeth of the stripper. The teeth are sawed out of oak boards, which in turn are nailed to planks *H* and *K*. This stripper can be made on the farm from readily available material at the expenditure of a few dollars. The comb stripper illustrated herewith can be of any desired size ranging from 1 foot to 10 feet in width, depending on the quantity of seed to be gathered. The handswung strippers are usually about 1 foot wide with the teeth 10 inches long. The particular stripper illustrated (1) is 3 1/2 feet wide. This is a convenient size where seed from 3 to 20 acres is gathered. The stripper 3 1/2 feet wide can easily be swung on the axle of the wheels taken from an old buggy, between the hind wheels of a buggy or even of a farm wagon.

This machine can be taken along any ordinary wagon road on its own wheels. If necessary, one man and a horse can operate the machine to good advantage, although a boy to assist in bagging the seed and cleaning the teeth when they become choked up is advisable. The wider stripper may be swung between hayrake wheels or set up on wheels of iron or wood.

If these wheels be 18 inches or less in diameter, the stripper can be placed above the axle. It is necessary that the seed be fully ripe in order to strip easily, and it is also desirable that the ground be given level tillage in order to facilitate the operation of the stripper.

#### 947 - Review of Patents.

##### *Tillage Machines and Implements.*

Canada	176 820. Cultivator.
	177 210. Scraper for disc plough.
Denmark	22 257 — 22 258. Motorcultivator with working parts.
France	482 155. Motorplough for vineyard cultivation.
United Kingdom	106 878. Harrow.
United States	1 232 025. Rotating ploughing wheel for motor plough.
	1 232 240. Wheel-adjusting mechanism for wheeled ploughs.
	1 232 380 — 1 233 139. Harrows.
	1 232 420 — 1 233 040 — 1 233 136. Motorploughs.
	1 232 483 — 1 232 661 — 1 233 751. Ploughs.
	1 232 965. Riding attachment for drags.
	1 232 997. Plough with removable share.
	1 233 090. Cultivator.
	1 233 412. Tilling machine.
	1 233 734. Sulky plough.
	1 233 760. Agricultural implement.
	1 233 778. Subsoiler.
	1 234 002 — 1 235 512. Cotton chopper.
	1 234 760 — 1 234 761. Engine gang plough.
	1 235 176. Attachment to ploughs.

*Drainage and Irrigation.*

- Canada 176 982 — 177 183. Sprinklers.  
 United States 1 232 029. Drainage system.  
 1 232 838. Ditching plough.

*Manure Distributors.*

- United States 1 234 362. Manure spreader.  
 1 234 525. Fertilizer attachment for planting machines.

*Seeding and Planting Machines.*

- Canada 177 114. Seeder mechanism.  
 Denmark 22 236. Potato planter.  
 United States 1 231 558. Planter.  
 1 231 701. Planter heel attachment.  
 1 232 288. Land marker.  
 1 233 146. Maize planter attachment.  
 1 233 167. Attachment for checking maize without a wire.  
 1 233 205. Cotton planter.  
 1 233 208 — 1 234 592. Maize planters.  
 1 233 375. Grain drill.  
 1 234 372. Disk grain-drill.  
 1 234 745. Disk attachment for planters.

*Cultivators, etc.*

- United Kingdom 107 257. Thinning root-crops.  
 United States 1 232 149. Rotary rod weeder.  
 1 232 188. Garden implement.  
 1 233 121. Cultivating implement.  
 1 233 550. Adjustable cultivator.  
 1 233 731. Attachment for maize cultivator.  
 1 234 453. Rod weeder.  
 1 234 581. Weed destroying machine.

*Control of Diseases and Pests of Plants.*

- Spain 64 646. Insecticide treatment increasing the efficacy of sulphating.  
 Switzerland 75 746. Mouse-trap with automatic shutter.  
 United States 1 231 877 — 1 232 762. Insect-traps.  
 1 232 679. — 1 235 473. Boll weevil catcher.  
 1 235 392. Weed and seed destroyer.

*Reapers, Mowers and Other Harvesting Machines.*

- Canada 176 919. Maize harvester.  
 177 117. Grain shocker.  
 United Kingdom 106 915. Sharpening reaper, etc., knives.  
 United States 1 231 690. Attachment for grain binders.  
 1 232 229. Harvester elevator.  
 1 232 652 — 1 232 854 — 1 233 955 — 1 234 803. Grain shockers.  
 1 232 681. Binder attachment.  
 1 233 134. Harvesting machine.  
 1 233 303 — 1 233 418. Maize harvesters.  
 1 233 907. Cotton picker.

- 1 233 950. Sickie-bar.  
1 234 528. Mowing machine.

*Machines for Lifting Root-Crops.*

- Denmark 22 193 — 22 314. Root toppers and harvesters.  
United Kingdom 107 066. Digging root crops.  
United-States 1 231 593 — 1 231 836 — 1 232 086. Beet harvesters.  
1 231 837 — 1 235 490. Beet toppers.  
1 233 805. Peanut harvester.

*Threshing and Winnowing Machines.*

- Canada 177 169. Grain cleaner.  
177 276. Grain elevator.  
United States 1 231 951. Cotton-seed linter.  
1 232 064. Bean and pea hulling machine.  
1 232 405. Extension feeder for grain threshers or separators.  
1 232 947. Screening mechanism for threshing machines.  
1 234 168. Threshing machine.

*Machines and Implements for the Preparation and Storage of Grain, Fodder, etc.*

- Denmark 22 212. Boxes for conveyance of fruits, etc.  
Spain 64 769. Machine for separating the kernel from the shell.  
Switzerland 75 628. Green fodder press.  
75 742. Silo for maize ensilage and installation device.  
United Kingdom 107 307. Hay-bogies.  
United States 1 232 251. Fruit press.  
1 232 270. Banana heater and ripener.  
1 232 271. Method of preserving fruits and vegetables fresh.  
1 233 038. Hay stacker.  
1 233 308. Ensilage elevator.  
1 234 078. Hay press.  
1 234 363 — 1 234 364. Grain stackers.  
1 235 044. Hay baling press.

*Forestry.*

- Canada 177 168. Machine for filing sawteeth.  
177 388. Tree sawing machine.

*Steering and Traction of Agricultural Machinery.*

- France 483 558. Improvements to agricultural tractors and their hitching with tilling implements.  
483 559. Improvements to agricultural tractors and cultivating implements for special use in vineyards and in horticulture.  
Switzerland 75 627. Driving device for agricultural machines of various kinds.  
United Kingdom 107 097. Motor tractors.  
United States 1 232 222. Sleigh attachment for vehicles.  
1 232 245. Hitching device for tractors.  
1 232 399. Gearing for tractors.  
1 232 629 — 1 234 145 — 1 234 148 — 1 234 437 — 1 234 604 — 1 235 400. Tractors.



- I 232 635. Tractor wheel.
- I 233 549. Clevis.
- I 234 813. Vehicle running gear.
- I 234 863. Transmission-gearing for motor agricultural machines.

*Feeding and Housing of Livestock.*

- Denmark 22 249 Halter for cows.
- United Kingdom 106 771. Harness.
- 106 801. Horse and like collars.
- 106 889. Machine for making horse-shoes.
- United States I 232 092. Apparatus for checking runaway horses.
- I 233 869. Horseshoe.
- I 234 054. Feeder.
- I 234 349. Self feeder for alfalfa hay for hogs.

*Aviculture.*

- Switzerland 75 744. Electrical incubator.
- United States I 232 868. Incubator.
- I 233 703. Chicken vermin trap.

*Fisheries.*

- France 483 597. Set of fishhooks.
- Switzerland 75 630. Artificial bait.

*Industries Depending on Plant Products.*

- Spain 64 723. Process for making cork shavings agglomerates.
- 64 758. Grain, etc., grinding machine.
- 64 762. Defibrating machine.
- United Kingdom 107 218. Bread making process.

*Dairying.*

- Canada 177 032. Milking machine.
- 177 150. Dash churn.
- 177 341. Cream comminuting process.
- Switzerland 75 652. Device for making butter.
- United States I 231 866. Milk aerator.
- I 232 184. Churn.
- I 232 568. Regulating device for centrifugal cream separators.
- I 232 810. Suspension and driving device for centrifugal cream separator bowls.
- I 232 811. Centrifugal cream separator.
- I 233 404. Indicator for milk bottles.
- I 233 446. Dried milk and method for producing the same.
- I 233 668. Milking machine.

*Farm Buildings.*

- Switzerland 75 743. Stable floor.
- United States I 232 388. Silo-roof.
- I 232 604. Silo.
- I 233 719. Gate.

FARM  
BUILDINGS

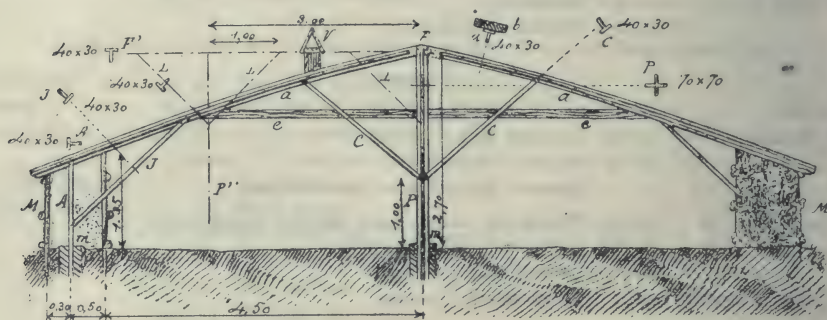
948 - **A Potato Storehouse.** — I. RINGELMANN, MAX, in *Journal d'Agriculture pratique*, Year 81, Vol. 30, No. 5, p. 91, 1 fig. Paris, March 8, 1917. — II. KROTOFF, M., in *Bulletin de l'Union des Agriculteurs d'Egypte*, Year 15, No. 120, pp. 83-87, 1 fig. Cairo, June-July, 1917.

I. — A storehouse used on a farm at Loir-et-Cher, France, is described as suitable for storing the potato crop from about 74 acres to be used for the manufacture of starch.

The appended figure shows the details of the building, which is very simple. The potatoes always kept very well in it.

Each truss, 10 metres long, is supported by two posts *A* of plain T-iron, and one centre post *P* of crossed iron (the dimensions of the irons are given in mm. on the figure). The rafters *a*, slightly curved, are reinforced by struts *I* and *C*. All the parts, except the centre post *P* are of plain T-iron, bolted together.

On the straining-sill of the rafters *a* is a board *b* laid flat and bolted at intervals to the iron *a*; the board *b* receives the battens. The posts



Potato Storehouse: transverse section.

*A* and *P* are fixed into brick beds. The ridge, whose projection is shown by the dotted line *FF'*, is supported by straps *L* bolted to the posts *PP'*. Between each truss (3 metres apart) is placed a small, plain, wooden truss made of two pieces of wood, similar to those used for *b*, forming false rafters joined by a tie beam *e*, placed edgewise, the two extremities of which are nailed to the false rafters. The wood battens are tongued and grooved, being placed horizontally on the trusses without purlins or spars. The boards are oiled, and covered with tarred felt.

The walls of the long side *M* and those of one of the gables are made of a framework 0.80 metres thick, filled with sand held by a vertical branching wickerwork, supported by horizontal stakes. The floor of the store is slightly raised, and drained by the ditches outside, from which the earth for the wall *M* was taken. Wooden ventilators *V* are placed in the roof. During very cold weather the potatoes are covered with straw.

II. — In Egypt the chief difficulty to be overcome is the damp heat. Care must be taken to store only ripe, dry and healthy potatoes, and to do so

when the temperature is lowest, that is to say, between 2 or 3 in the morning and sunrise. A floor which may be highly recommended consists of a slatted false floor made of laths or other material, so that there shall be a space of from 15 to 20 cm. between the heap and the groupnd.

A store to hold 15 to 20 tons of potatoes should cover an area of about 40 square metres (8 m.  $\times$  5 m.). If 1 metre be left for the passage, about 16 or 17 planks 5  $\times$  15 cm. thick and 4 metres long should be laid down at regular intervals of about 50 cm. On top are placed perpendicularly rather thick laths 20 to 30 cm. wide with the same space between them; a few only need be fixed to the planks with small nails.

The passage is formed by a wooden partition 1 metre high. The planks may be replaced by bricks one on top of the other, and the laths by any kind of wood as long as there is a free space of 15 to 20 cm. underneath, and a floor with an equal number of open and closed spaces. A minimum of from 450 to 500 kg. may be stored per square metre.

949. - **Designs for Dipping Baths for Sheep, in U. S. A.** — See No. 925 of this *Review* (with illustrations).

## RURAL ECONOMICS.

950 - **Farm Management Investigations in the United States.** — (Report of the Committee on Investigations of the American Farm Management Association) in *Record of the Proceedings of the Seventh Annual Meeting of the American Farm Management Association*, pp. 87-107. Washington D. C., 1917.

This report of the Committee on Investigations of the American Farm Management Association presented at the seventh annual meeting of the Association, held in Washington D. C., November 13-14, 1916, is designed to show the scope of investigation work in farm management now under way throughout the entire United States.

The data secured by the members of the Committee are presented under the following headings:

- A. State institutions from which no reports were received.
- B. State institutions reporting no work of a farm management nature.
- C. Condensed statement of farm management work at State Institutions.
- D. Condensed statement of farm management work of Federal departments.
- E. List of subjects suggested for investigation (and name of suggestor).
- F. Detailed description of farm management work reported for State institutions.
- G. Detailed description of farm management work reported for Federal departments.

An outline of the Farm Management Work reported for the office of Farm Management, U. S. Department of Agriculture, is here given:

*Farm Management Work reported for the Office of Farm Management U. S. Department of Agriculture, May 1916.*

1) *Project.* Cost of growing sugar beets: *Object*, to investigate farm practice in the production, equipment required, cost of production, profitableness of the enterprise, and geographic and



economic conditions making the crop desirable (1910) (1). — *Location*: Important sugar-beet districts of Michigan, Ohio, Colorado, Utah, Idaho, Montana and California. *Method*. — Modification of farm management survey. *Findings*. — During past two years 1314 enterprise records obtained in several areas; these now summarized and results being compiled. Additional data obtained during the summer of 1916.

2) *Project*. — Cost of producing hay and grasses: *Object*, same as preceding (2). Deals with crew management in making hay, etc. (1910). — *Location*: Important hay-producing States. *Method*. — Same as preceding. *Findings*. — Data on cost of production obtained in New-York, Pennsylvania, Iowa, Nebraska, Kansas and Oklahoma.

3) *Project*. — Cost of growing potatoes: *Object*, same as preceding (1912). — *Location*: Important potato growing districts in 19 States, Maine to California. — *Method*: Same as preceding. — *Findings*: Nearly 900 cost records obtained and compiled.

4) *Project*. — Cost of producing cotton: *Object*, same as preceding (1913). — *Location*: Important cotton growing districts. — *Method*: Farm management survey and modification thereof. — *Findings*: Compilation of several hundred records.

5) *Project*. — Cost of producing corn silage: *Object*, same as preceding, including also capacity of silos, shrinkage, etc. (1915). — *Location*: Important silage growing districts in the North. — *Method*: Modification of farm management survey; cost records kept in cooperation with farmers and Experiment Stations. — *Findings*: Several hundred records from personal interviews; studies have given certain records covering long periods; weighings made to determine silo capacity and shrinkage.

6) *Project*. — Cost of fruit production: *Object*, same as preceding (1912). — *Location*: All important fruit-growing districts in the United States. — *Method*: Modification of farm management survey; cost records of apple production on New-York farms, in cooperation with Bureau of Plant Industry. — *Findings*: Nearly 1000 records taken on apple production.

7) *Project*. — Economics of farm woodlots: *Object*, data over wide range to ascertain relative importance (1915). — *Location*: Sixteen typical sections, 50 to 75 farms each. — *Method*: Farm management survey in general; woodlots inspected in cooperation with Forest Service.

8) *Project*. — Cost of producing feeder cattle: *Object*, to determine cost under different conditions with reference to the farm as a whole. Includes maintenance of breeding herds (1914). — *Location*: Important stock-producing regions. — *Method*: Modification of farm management survey; cooperation with Bureau of Animal Industry. — *Findings*: Several hundred records from Central West; studies to be continued in other livestock regions.

9) *Project*. — Cost of finishing beef cattle: *Object*, to determine cost in relation to profitability of farm business (1914). — *Location*: Same as preceding. — *Findings*: Incomplete.

10) *Project*. — Cost of producing baby beef: *Object* (3), to determine cost under different farm conditions; complete data of breeding herds obtained; special attention to determine factors that make it desirable (1914). — *Location*: Same as preceding. — *Method*: Same as preceding. — *Findings*: published.

11) *Project*. — Cost of producing dairy cattle: *Object*, same as under finishing beef cattle (1906). — *Location*: Farms where calf-production is important. — *Method*: Cost records in cooperation with farmers and Experiment Stations in New York, Ohio, Wisconsin and Minnesota. — *Findings*: Incomplete.

(1) The date given in parentheses immediately after the statement of each project throughout this entire list refers to the time the project was begun.

(2) Wherever the statement "Object, same as preceding" appears in this list under the heading "project", reference is made to practice in production, equipment required, cost of production, profitability of enterprise and the geographic and economic conditions which render the crops desirable as a part of the farm business.

(3) See R., August 1917, No. 743.

(Ed.)

12) *Project*. — Cost of producing dairy products with relation to the profits of the farm business (1906). — *Location*: Thus far only individual farms and in regions where farm management surveys have been made. — *Method*: a) Farm management survey; b) detailed cost accounts in cooperation with farmers and Experiment Stations. — *Findings*: Records from farmers over series of years compiled and submitted for publication; studies made on over 1000 dairy farms in Pennsylvania, Michigan, and Wisconsin.

13) *Project*. — Cost of raising colts and maintenance of farm work horses (1906). — *Location*: All sections where horse labour is important. — *Method*: Cost accounts in cooperation with farmers and Experiment Stations in New-York, Wisconsin and Minnesota. — *Findings*: Incomplete; some cost records compiled.

14) *Project*. — Relation of farm practice to crop yield (1912). — *Location*: All sections of the United States. — *Method*: Modification of farm management survey. — *Findings*: About 2000 farms studied with reference to use of manure and fertilizers.

15) *Project*. — History and distribution of farm enterprises: *Object*, to determine geographic factors which have directed the development of American agriculture (1912). — *Location*: Entire United States. — *Method*: Compilation of available geographic and historical data, and correlation with agricultural practices and farm management experience; in cooperation with census office and various bureaux of the Department of Agriculture. — *Findings*: Maps and charts prepared for Atlas of American Agriculture, also supplementary Atlas relative to the agriculture of the world.

16) *Project*. — Farm management surveys; comprehensive analysis of farm business (1909). — *Location*: Surveys made in eight regions and various small areas. — *Method*: Farm management survey; personal interviews with farmers. — *Findings*: Published.

17) *Project*. — Cost of farmer's living; what farm contributes, etc. (1914). — *Location*: Selected areas in various States. — *Method*: Modification of farm management survey.

18) *Project*. — Farm tenantry; to determine principles, systems, lease contracts, etc. (1906). — *Method*: Farm management survey; cooperation with Iowa State College. — *Findings*: Published.

19) *Project*. — Farm Equipment: *Object*, To determine economics of, character, cost and adequacy in relation to farms of different types and sizes (1906). — *Location*: General; selected areas for specific problems. — *Method*: a) Modification of farm management survey; b) by circular letters or interviews. Some cooperation with Bureau of Plant Industry. — *Findings*: Published.

20) *Project*. — Cost and efficiency factors in greenhouse heating (special) (1913). — *Location*: Nearly every State. — *Method*: Data obtained from greenhouses directly and by questionnaires. — *Findings*: Numerous factors appear to have bearing on fuel consumption in greenhouses, such as repair of houses, sizes of boilers, grate area, etc.

21) *Project*. — Farm Equipment (special); use of milking machines on dairy farms (July 1915-March 1916). — *Location*: Dairy sections of New York, Michigan and Illinois. — *Method*: Modification of farm management survey. — *Findings*: Mechanical milkers aid in efficient organization of dairy farms.

22) *Project*. — Farm Equipment (special); cost of fencing in North Central States (1914-1916). — *Location*: Twelve North Central States. — *Method*: Personal interviews and use of questionnaires. — *Findings*: Published.

23) *Project*. — Farm Accounts; practical methods of farm bookkeeping and accounting (1906). — *Location*: General. — *Method*: Studying existing systems; records kept in cooperation with farmers and Experiment Stations. — *Findings*: Progress made in determining and clarifying principles underlying the subject of farm accounts.

24) *Project*. — Weeds and tillage in relation to farm management (1902). — *Location*: All sections of the United States. — *Method*: chiefly by reconnaissance survey; field experiments in cooperation with farmers and Experiment Stations. — *Findings*: Methods of controlling worst weeds; catalogue describing 100 of such weeds.



25) *Project*. — Clearing and use of logged-off lands (1908). — *Location*: cut-over sections of the United States. — *Method*: Farm survey to an extent. — *Findings*: Published.

26) *Project*. — Application of farm economics to farm practice: *Object*, to interpret economic conditions prevailing in each agricultural region; to correlate data collected by various agencies of the Department and State institutions; and to utilize such data to develop systems of farm organization and operation adapted to various types and sizes of farms prevailing or that should prevail in different sections of the country. — *Location*: The United States, divided into geographical sections. — *Method*: Data obtained by analytical studies of farm business; special studies of different enterprises and general farm practice in each region; cooperation with State Agricultural Colleges, Experiment Stations, States Relations Service and individual farmers. — *Findings*. Results reported separately for each region.

*Subproject*. — Farm organization in Northeastern region. — *Findings*: Farm analysis studies on 1800 New England farms (1914-1915) and extensive records obtained; also 600 Farm records in Chester County Pa. Organization studies on several individual farms. Three hundred and fifty truck-farm records from Gloucester and Mercer counties N. J., during two successive years.

*Subproject*. — Farm organization in North Central States. — *Findings*: Analyses of over 800 farms in northern cut-over districts compiled; progress made on farming systems for said districts; special study of management of sandy farms in northern Indiana and southern Michigan.

*Subproject*. — Farm organization in Middle Atlantic and Appalachian region. — *Findings*: Progress in working out systems of farming for this region.

*Subproject*. — Farm organization in the cotton belt. — *Findings*: Analyses of entire farm business, crop and stock costs on several hundred farms in cotton States and results in manuscript ready for publication.

*Subproject*. — Farm organization in the corn belt. — *Findings*: Progress in development of better farming systems - more efficient use of labour, more livestock, more profit.

*Subproject*. — Farm organization in Middle West plains region. — *Findings*: Farm organization work not yet fully outlined, and only primary results available.

*Subproject*. — Farm Organization in Rocky Mountain and Pacific region. — *Findings*: Results of studies in Palouse country, Washington; in Oregon and in Arizona and Utah Valleys prepared for publication; similar work in Montana. Systems of bean, forage crops and alfalfa farming studied. Over 1500 farm analyses used as basis.

*Project*. — Special agricultural problems in the Rocky Mountain and Pacific region (1915). — *Location*: Limited areas in Rocky Mountain and Pacific regions. — *Method*: Farm Management survey to an extent; study of all economic features. — *Findings*: Immense amount of data collected relating to development of irrigated areas and economics of ranching for publication in near future.

A condensed statement of Farm Management Work at State institutions (Agricultural Experiment Stations) follows:

#### *Farm Management Work at State Institutions.*

*Arizona*. Farm management survey of the sugar and ostrich industries in the Salt River Valley.

*California*. Investigation into the financial side of farming as applied to the production of fruit, field, cereal and other crops of a similar nature. Investigations into the financial side of farming as applied to the production of beef, swine, poultry, sheep and other kindred subjects as applied to California. Justification of the acre or "handkerchief" farm as typified by the "Little Landers" idea. Capital required by California farmers going into diversified farming.

*Colorado*. Farm management surveys in selected dry land districts.

*Illinois*. Cost accounting on dairy farms. Cost accounting in connection with commercial orchardists. Systems of live stock farming studies by cost accounting.



*Indiana.* Cost of producing crops in Indiana.

*Iowa.* Farm management survey of Black Hawk, Tama, Grundy and Warren Counties. Farm Tenancy. Cost accounting from scattered farms in several counties of the state.

*Kansas.* Completed records of the farm business as shown by complete cost accounts. Studying farming conditions and factors affecting them by the Farm Management Survey Method.

*Kentucky.* Detailed farm management survey for the purpose of permanent modification of farming in the dark tobacco district.

*Minnesota.* Cost of producing farm products in Minnesota. Studies of the business of farming in Minnesota through the farm survey method.

*Mississippi.* Determination by cost accounting of the relative profits in dairying, beef cattle, farming, cotton and diversified farming in Mississippi. Determination of the relative managerial incomes on cotton, dairying and diversified farms in Mississippi.

*Missouri.* Farm cost accounting. Farm management survey made in Johnson county. Cost of family living on the farm. Distribution of Farm Labour. Animal units and feeding practice in the corn belt.

*Montana.* A farm management survey in the Gallatin Valley. Farm cost accounting. An agricultural survey in the Billings Sugar-Beet Region. A wheat enterprise survey. A sugar-beet enterprise survey.

*Nebraska.* The effect of climate and soil upon agriculture. Type of farming most profitable in Nebraska. Farm management survey. Selling apples and potatoes from box cars direct to the consumer.

*New Hampshire.* A corn production survey. Farm management surveys.

*New Jersey.* Profits from potatoes as a specialized type of farming. General farming as a source of profits in New Jersey. Profits from a specialized type of dairying. Profits from truck farming.

*New-York (Cornell).* The study of farm management.

*North Dakota.* Seasonal distribution of labour. Cost of producing agricultural commodities in North Dakota. Farm record investigations. Assembly and study of farm practice methods.

*Ohio (State University).* Cost accounting investigations on fifteen typical Ohio farms. Methods of renting land in Ohio.

*Ohio. (Experiment Station). Statistical Studies:* A study of the increase and decrease of the average yields of crops, and the reasons there for, in the various counties of the state; same with livestock. — *Rotations:* A study of the gross and net receipts from different rotations, the distribution of labour involved, the effect on the yields and on the physical and chemical characteristics of the soil. — *Types of farming:* A study of the types of farming in vogue in a given section, the fundamental reasons therefor and changes that may be desirable; the effect of these systems upon the land and upon the man. — *Successful and unsuccessful farms:* The studying and reporting of the farm management and farm practice methods in use on successful and unsuccessful farms. — *Small farms:* A study of the types of farming adopted to small farms in various sections of the state. — *Pastures:* A study of incomes from pasturelands as compared with cultivated lands. — *Permanent improvement:* A study of the character and cost of permanent improvements including fences, buildings and tile drainage. — *Farm equipment:* study of the character and cost of farm machinery and tools. — *Miscellaneous:* Beautification of the home and farmstead. Systems of farming as affected by markets and roads. Cost accounting. Cost of agricultural lime. Cost of tile-drainage.

*West Virginia:* Agricultural survey in the Greenboro Valley. Agricultural survey on 25 farms in Preston and the same number in Brooke county. A social and economic survey of Upshur County. An agricultural survey of selected farms in Preston County.

*Wisconsin:* Farm management surveys and demonstrations cost accounting. Study of agricultural history. Tenancy and labour problems. Marketing of Wisconsin butter. Marketing of city milk.

- 951 - **Farming in the Bluegrass Region** (A Study of the Organization and Management of 178 Farms in Central Kentucky). -- ARNOLD, J. H. and MONTGOMERY, FRANK, in *U. S. Department of Agriculture Bulletin* No. 482 (Office of Farm Management), pp. 1-32. Washington, D. C., February 19, 1917.

The purpose of this bulletin is to present a general description of the farm-management practices followed in the bluegrass region of Kentucky and to determine from analyses of the operations on about 200 such farms the relative efficiency of the different types of farming in vogue and the factors which seem to have the greatest influence on farm profits in that region.

It was found that specialized farms, those of the tobacco, stock, or dairy type, moderately diversified, are the most efficient in this region, and that the general mixed farms, more highly diversified, are the least efficient.

Thus, while diversity has a vital relation to profits here as elsewhere, it would appear that in the bluegrass region these specialized farms have found in moderate diversity the right degree for maximum profits.

Of the factors which determine profits, size of business was found to have the greatest weight, with utilization of pasture and yield of field crops per acre important secondary factors. Size of farm has here no direct bearing upon labour income. It does, however, determine the character of the farm organization, the small farms naturally turning more to the cultivation of tobacco and the large farms to grazing.

The analytical data collected with this survey, which have led to the conclusions mentioned, are presented in XXI Tables and discussed in the following order: method of study; general description of the region; history of bluegrass farm enterprises; rotation of crops; soil; climate; seasonal distribution of operations; labour and power units required; land tenure and cropper labour; importance of size of farm; types of farms; relation of type of farm to efficiency, to utilization of pasture, to crop yields; relation of diversity to profitable farming; cost of production and prime factors in profitable farming.

952. — **Investigations into Cost and Methods of Clearing Land.** — See No. 899 of this *Review*.

## AGRICULTURAL INDUSTRIES.

INDUSTRIES  
DEPENDING  
ON PLANT  
PRODUCTS

- 953 - **A Comparison of Several Classes of American Wheats and a Consideration of Some Factors Influencing Quality.** — THOMAS, L. M., in *U. S. Department of Agriculture, Bulletin* No. 557, pp. 1-28. Washington, D. C., May 18, 1917.

The investigations reported in this Bulletin were made in the Office of Grain Standardisation of the Bureau of Plant Industry in cooperation with the Office of Markets and Rural Organization, in connection with the enforcement of the United States Grain Standards Act. The fitness of the several types of wheat for the manufacture of white flour and the adaptation of the flour from these several types to the manufacture of different kinds of bread products were studied, in view of a division of wheats of

distinctly different character into general classes. A comparative valuation of the wheat within any one class was also made.

In all, five distinct classes of wheats, grown in various sections of the United States, have been studied :

1) Soft red winter wheat, or " red winter ", as it is better known on the market, is the principal class of wheat grown in sections east of the Mississippi River, in the State of Missouri, and in parts of the States adjoining the west and south.

2) Hard red winter wheat is grown chiefly in Nebraska, Kansas, and parts of Oklahoma and Montana, although small quantities are grown in the adjoining States.

3) Hard red spring wheat is grown in North Dakota, Minnesota, South Dakota and Montana. This wheat is more generally known commercially as northern spring wheat.

4) Durum wheat is grown in about the same territory as hard red spring wheat and to a limited extent in the southern great Plains area and Intermountain and Pacific Coast States.

5) White wheats are grown to a comparatively small extent in some of the Eastern States and more generally in the Intermountain and Pacific Coast States. Only a limited amount of work was done on this class of wheats, and in this report reference is made only to some factors relating to the quality of the flour produced from them. There are other classes of wheats, particularly the western red wheats, both spring and autumn sown, of which no mention is made in this bulletin.

A partial survey of the results of this work is presented in the following summary.

1) Normal, plump, dry and sound wheat of all classes yields approximately the same percentage of flour. Over 80 per cent. of the samples of each of the three classes of the more common wheats, soft and hard red winter and hard red spring, yielded between 67 and 75 per cent. flour.

2) There is direct relation between milling yield and the moisture content of wheat, and in a general way the yield varies inversely with the moisture content. Were it possible to eliminate other factors, such as variation in plumpness of the kernels, it is probable that this relationship would be more apparent.

3) The weight per 1 000 kernels or average weight of kernels, has very little value in judging the potential flour yield.

4) Although there are frequent exceptions when individual samples are considered, average results show a very striking relation between weight per bushel and flour yield, the latter varying directly with the former. The ratio between these two figures, however, is not quite the same for the different classes nor is it the same for all varieties within each class.

5) In colour the bread from the flour of the various classes of common wheat shows about the same ranges and averages. The flour from durum wheat is considerably more creamy and thus averages several points lower than that of any other class.

6) Bread from all normal durum samples has a tint or colouration



varying from slightly creamy to bright yellow, while, of the hard red winter samples, 77.6 per cent. show a noticeable creamy tint, of the hard red spring samples 69.5 per cent, and of the soft red winter samples only 18.9 per cent.

7) The general results indicate that test weight and soundness when considered together, are of far more value in appraising quality than when either is considered by itself.

8) Small amounts of inseparable material are generally accompanied by a decrease in flour yield, as would be expected, since, as a rule a large part of such material usually finds its way into the bran and shorts.

9) Loaf volume and texture are the two factors which are considered as indicative of strength. While a great range of strength was found within each class of wheat, the averages for each class show considerable differences between the various classes when considered as a whole. Given in order from weakest to strongest the classes are soft white, soft red winter, durum, hard red winter, and hard red spring wheat.

10) The average loaf volume in cubic centimeters for each of these classes is soft white wheat, 1 909; soft red winter, 1 965; durum, 2 070; hard red winter, 2 219; and hard red spring 2 421. In the matter of texture the several classes stand in the same order, except that soft red winter has a slight advantage over durum wheat.

11) Of the four more important classes of wheat under consideration, durum is the highest in crude-protein content; hard red spring, second; hard red winter, third; and soft red winter, fourth.

12) High crude-protein content as a rule is accompanied by high strength, but the relation between these two factors varies with the different classes of wheat, and extremely high crude-protein content is sometimes accompanied by a decrease in baking strength.

13) The average water absorption of the flour from durum and from hard red spring wheat is about the same and that of hard red winter is only slightly lower.

The water absorption of the soft wheats averages from 3 to 4 per cent lower than for the hard wheats. The range of water absorption of each class varies within wide limits.

14) There is a direct relation between the water absorption of the flour and the bread yield of a unit quantity of the same. As a rule, the higher the absorption the greater the weight of the loaf.

954 - **The Utilisation of the Horse-Chestnut.** — GORIS, A., in *Comptes Rendus des Séances de l'Académie des Sciences*, Vol. 165, No. 10, pp. 345-348. Paris, September 3, 1917.

In the course of previous work on the composition of the horse-chestnut (*Aesculus Hippocastanum* L.), the author had considered the possibility of making use of the different parts of this tree. The present paper leaves completely aside everything connected with the utilisation of the wood or the bark, and only takes into account the importance of the fruit as a food.

The horse-chestnut is a seed enclosed in a tegument of well-known colour; it is composed of two cotyledons, closely joined, and a radicle fitting into a cavity in the seed. There is no albumen.

The tegument contains aesculin and a special tannin: aesculitannic acid. It is of no economic value, and, on the contrary, it makes treatment of the seed difficult. When fresh it can be removed fairly easily, but, in the dried seed, it adheres closely to the cotyledon; it makes crushing difficult and bits of it are found mingled with the meal.

The dry cotyledon contains:

Fatty matter . . . . .	2 to 3 %
Nitrogen . . . . .	6 to 7 %
Starch . . . . .	20 to 30 %

with bitter substances of the saponin group and colouring matter.

Neither aesculin nor tannin are found; these belong exclusively to the tegument.

The oil is not of great interest. It is present in too small a proportion to justify extraction for commercial purposes; moreover it is very difficult to extract from the fresh chestnut. As a result of the saponin it contains, it forms such a cohesive mass that the ordinary fat solvents do not dissolve it.

The only commercial interest the saponins have is as a lather-producing substance. If necessary they can be isolated from the *fresh* chestnut. During desiccation or fermentation these substances undergo considerable change without, however, disappearing altogether, and treatment with solvents then becomes possible.

From another point of view these saponins have an intense physiological action, which gives the medical preparations made from them their specific action in congestion of the venous system (haemorrhoids, varix, phlebitis, broken-wind in horses). It is especially these pharmaceutical qualities, and their bitterness, which prevent the utilisation of the horse-chestnut.

It is, therefore, impossible to use the pulp or the flour without previously removing these substances, and various methods of doing this have been recommended: exhaustion with alcohol (BAUMÉ), washing with pure water (PARMENTIER, BAUMÉ), washing with alkaline water (POTTIER, FLANDIN), and washing with acid water (VERGNAUD-ROMAGNÉSI).

In his experiments the author gave preference to washing with acid water. He used 1/1000 hydrochloric water, but it is obvious that other acids will serve the same purpose.

This treatment is quicker than with pure water, less expensive than the use of alcohol, and gives a whiter flour than washing with alkaline water. By this method 20 to 25 % of a fine, white flour, having neither smell nor taste, may be obtained in the laboratory. The starch particles are irregular, some small, round or oval, others large, pyriform or elliptical, with a linear or star-shaped hilum clearly visible in the largest part of the grain; striae barely visible.

It is possible to ascertain whether the saponins have been removed from the washing water by looking for either their biological properties



(haemolysis of red corpuscles), or their physiological properties (stupifying action on fish).

This flour might be used for the preparation of alcohol or even as a food. The Museum of the Pharmaceutical School possesses foodstuffs prepared with it. Moreover, there were at one time, near Paris, starch-factories for horse-chestnuts (De Callias). They failed for the economic reasons given above.

The residue from the extraction of starch, the cake, after treatment, is also free from bitterness; it might very possibly be used as a food for cattle.

955 - **Observations and Experiments on the Manufacture of Tea at Java.** — DEUSS,

J. J. B., in *Mededeelingen van het Proefstation voor Thee*, No. I, II. Semarang, 1917.

The temperature of tea-leaves during fermentation was studied in about 30 factories in plantations situated in different districts, varying greatly as regards climatic conditions.

It was possible to divide the results into four groups, according to the position of the factory, and the conditions of temperature and moisture. These results show that a knowledge of the climatic conditions will allow the previous determination of the progress and duration of the fermentation of tea leaves.

It is unnecessary to keep the mass of fermenting leaves at a temperature below 26° C, because leaves which pass through the roller previous to fermentation reach a temperature much above 26° C.

Some factories stir the mass of fermenting leaves; this method seems to dry the leaves too quickly and to interrupt fermentation. Desiccation amounting to as much as 10-15 % was found, and this must certainly hinder the regular progress of fermentation.

Attention is drawn to the necessity of keeping a sufficient degree of moisture in the sheds where fermentation is carried out. In factories high up in the mountains it may even be necessary at times to heat the shed in order to hasten fermentation.

In order to regulate fermentation it is advisable to sort the leaves previously according to size and quality. By the present method the leaves are sorted after fermentation and drying.

A heap of fermenting leaves should not be more than 4 cm. thick, and the temperature should be kept at 25° C. at the lowest.

The author made experiments on drying with quick lime, but the results were far from satisfactory. Drying *in vacuo* also gave unsatisfactory results. Experiments show that drying at a low temperature is detrimental to the quality of the tea, and that the usual method of drying with hot air is preferable.

Further remarks on the drying of tea are given in another chapter



## 956 - The Carbone Method for Retting Textile Plants by Microbiological Action.

— I. CARBONE, DOMENICO, Sopra un bacillo macerante aerobico, in *Annali d'Igiene sperimentale*, Vol. XXVI, Pt. 1, pp. 57 + 11 plates. Rome, 1916. — II. CARBONE, DOMENICO, Sulla macerazione rustica della canapa: Prima nota, in *Le Stazioni Sperimentali agrarie italiane*, Vol. IV, pp. 261-299. Modena, 1917. — III. TOMBOLATO, ARTURO, Il metodo Carbone per la macerazione microbiologica delle tessili e la sua importanza pratica. Abstracted from: *I Progressi nelle Industrie Tintorie e Tessili*. Bergamo, 1917.

Many microbiological, as well as chemical, methods have recently been proposed for the industrial retting of textile plants. The first methods, besides being less expensive to install and work, also give a better quality fibre than the latter methods. Prof. GIACOMO ROSSI's (1) method for the industrial retting of textile plants by microbiological action is the most recent. The method is based on the passage of air through the macerating mass, which had already been proposed by MARMIER (1901) as a means of regulating and completing retting caused by special pectic areobic ferments, and on the use of cultures of a spore-bearing bacillus, *Bacillus Cornesi* Rossi, which, according to Dr. CARBONE is identical with, or very similar to, *Bacillus asterosporus* Myer-Migula. This method, tested widely in Italy and in France, gave *satisfactory* results, for it shortens the time of retting, gives no bad smell, and allows even bad quality hemp to be retted more rapidly than in field retting-pools. To these advantages must be opposed the fact that the Rossi method applied to hemp gives a type of retting which differs from that obtained by the field methods; the green parts of the retted bark remain adherent to the fibres, and, in order to separate and whiten the fibre after retting, special machines must be used for washing it with water. Moreover, the harl obtained by Rossi's method is rather different from that obtained in the field pits, on which the market price is based; for the moment at least, then, there will be difficulty in disposing of the first type. The drawbacks may be attributed to the fact that the aerobic pectic ferment used by Prof. Rossi is not included in the active flora of the field pits (it was isolated from a decomposing potato).

It is for this reason that Dr. CARBONE, considering it necessary first of all to search for "retting agents such as are used in the fields so as to be able to use the knowledge thus gained of their biological requirements for discovering the best means of favouring the victory of useful factors on harmless or deleterious ones", isolated from the mud of some of the Bologna retting-pits an obligate anaerobic bacillus, which he called *Bacillus felsineus*, and which is capable of retting hemp and many other textile plants.

Dr. CARBONE and M. TOMBOLATO have successively isolated this bacillus from the mud of pits in the province of Bologna, from the mud of two pits of Rovigo, and from certain retting products of the province of Naples, and it seems highly probable that *B. felsineus* is the active species in the Italian hemp-pits.

This bacillus, together with the *Saccharomyces*, actively rets hemp, in stalks or green harl, in less than 2 1/2 days at a temperature of 37° C.

(1) See the original article: — Prof. GIACOMO ROSSI, *Industrial Retting of Textile Plants by Microbiological Action*, in R., August, 1916, pp. 1067-1075.

It gives the same type of retting as the field pits, i. e., complete detachment of the woody parts and its spontaneous exfoliation. This renders the use of special machines and washing unnecessary for obtaining a white harl, and the manual labour following on CARBONE'S retting method is identical with that generally in use for the product of field retting. The CARBONE method is being extensively tested during the 1917 hemp season. To apply it, it is sufficient to build pools, heat the water to 37° C. by means of a current of steam or any other method, and use the desired ferment, which can be prepared at a minimum cost.

The experiments carried out by Dr. CARBONE up to the present show that, besides hemp, *B. felsineus* is capable of retting flax, mulberry, ramie, nettle, broom, various Malvaceae, *Fourcraea*, *Sansevieria*, and various species of agave. This bacillus always gives a very rapid retting and very fine, white, well-separated fibres.

957 — **Influence of Various Factors on the Quality of Rubber.** — DE VRIES, O.: I. Influence of rolling on crepe-rubber, in *Archief voor de Rubbercultuur in Nederlandsch-Indië*, Year I, No. 1, pp. 17-22. — II. Influence of the rubber content of latex on the quality of the rubber, *Ibidem*, pp. 25-32. — III, Influence of the amount of acetic acid on the quality of the rubber, *Ibidem*, pp. 35-39. — IV Influence of the age of the trees on the quality of the rubber, *Ibidem*, No. 3, pp. 169-174. Batavia. 1917.

I. — **INFLUENCE OF ROLLING ON CRÊPE-RUBBER.** — The Author summarises as follows his own experiments, partly using those of Dr. N. L. SWART,

The opinion is still largely held that prolonged crepeing must be prejudicial to the fresh coagulum. EATON and GRANTHAM had already stated in 1915 (*Agric. Bull. F. M. S.* III, 218) that the influence of crepeing, if any, is only small, while after these experiments had been finished, the results of CAMPBELL (*Bull. Depart. Agric. Ceylon* No. 24) became known. After crepeing as often as 50 to 70 times in the washing machine, no difference could be found in the vulcanised product.

The author repeated these investigations, first because the above mentioned investigators did not study the influence of smooth rollers, in which the rubber is most pressed, and further because no determinations of viscosity were mentioned, although a change in the viscosity of the raw rubber would be the first thing to be expected.

The influence of crepeing can only be determined if the resulting pieces of crepe are of the same thickness: difference in this respect may cause a difference in the rate of drying, and thereby a difference in the rate of cure. This being allowed for, one would expect from prolonged crepeing: a diminution of tensile strength and viscosity and a slower rate of cure. These experiments tend to show, in confirmation of the experiments of EATON, GRANTHAM and CAMPBELL, that often there is no difference at all, even with much longer crepeing than is ever practised on estates; in some cases small differences were found, though of no practical importance; and only in one case, where the rubber became somewhat warm by prolonged treatment on smooth rolls, was a marked diminution in viscosity found. Tearing and cutting of the fresh coagulum seems to have little influence on its inner qualities; current opinion on this point is as absurd as the speculations on the "short or long fibre" of rubber. In actual estate-practice, of course, rolling as little as is consistent with a good outward appearance of the crepe means a gain in time, fuel, and wear of machinery. Thin crepe, under present market conditions, has the advantage of rapid drying, though thick crepe with its rapid rate of cure might be preferred by certain manufacturers. From our experiments the conclusion may be drawn that rolling a number of times more or less has no influence on the inner qualities of the rubber, provided enough water



is used to keep the rubber and rolls cool. In trying to prepare crepe of uniform appearance and thickness it does not matter if this is reached by passing the rubber a few times more or less through the rolls.

II. — INFLUENCE OF THE RUBBER CONTENT OF LATEX ON THE QUALITY OF RUBBER. — The Author gives the following summary of his experiments:

That the dilution of the latex would have an influence on the quality of the rubber obtained from it by coagulation was to be expected. Rubber, as a colloid, absorbs part of the serum substances in coagulating and retains them during the crepeing and washing process, and the more concentrated the latex, the more serum-substances the rubber encloses and retains.

Several experiments were made to determine what the influence of this factor may be in the process of rubber preparation. The results were:

1) The tensile strength showed no difference, though in some cases there were indications that a very diluted latex gave a lower tensile strength; further experiments will, however, be required to prove or disprove this.

2) The slope or type of the curve showed no difference.

3) The viscosity was diminished somewhat by dilution, but not to an important extent.

4) The rate of cure was diminished in an appreciable degree by dilution. The following table summarises the differences for the two last named qualities:

1st. Experiment			2nd. Experiment		
Dilution of latex per cent.	Average		Dilution of latex	Average	
	Index of viscosity	Standard time of cure		Index of viscosity	Standard time of cure
11	1.71	145 min.	6 %	1.70	150 min.
16	1.76	about 135 "	9	1.71	145 "
21	1.77	130 "	12	1.74	about 140 "
26	1.78	125 "	14	1.74	140 "
31-38	1.79	120 "	17	1.745	135 "

The not unimportant difference in rate of cure makes it desirable to dilute the latex to a standard rubber content to obtain rubber of uniform quality.

In the preparation of smoked sheet a standard dilution is in general use; in Java, 15% dry rubber is mostly chosen as the dilution giving a coagulum that can be easily worked.

In the preparation of crepe, a standard dilution of latex is not generally accepted, but the above mentioned facts show it to be desirable. It is to be remarked that undiluted latex gives the quickest curing rubber, but using undiluted latex in coagulation has the great disadvantage that on rainy days a product of variable quality is obtained.

It may be emphasised that a standard dilution of the latex is not only desirable with a view to obtaining a uniform product, but also for regular and economical work in the factory. In fact, this is the only way to use acetic acid sparingly. When the rubber content of the latex is unknown, on some days more acetic acid than necessary is added, resulting in a loss; and on other days not enough is used, giving a milky serum and loss of rubber.

III. — INFLUENCE OF THE AMOUNT OF ACETIC ACID ON THE QUALITY OF THE RUBBER. — Partly based on experiments of Dr. P. ARENS



and Dr. N. L. SWART, the Author summarises the results of his experiments as follows:

That the amount of acetic acid used in coagulation has no great influence on the inner qualities of the rubber, is already known from the results of other investigations. EATON (*Agr. Bull. F. M. S. IV*, 1965) signalled this as a distinct advantage of the use of acetic acid over other acids such as sulphuric. Several of the writer's experiments had been started before EATON's results were published; he now reviews the results obtained, as they not only confirm, but also tend to amplify, the already known facts. The results may be summarized as follows:

- 1) For quantities of acetic acid ranging from the minimum to four times as much, the tensile strength of the rubber shows no difference.
- 2) The type of curve remained the same in all experiments in which the rubber was prepared as crepe; in one experiment with smoked sheet the type was slightly less when using a double quantity of acetic acid, but this result will have to be checked by further experiments.
- 3) The rate of cure diminishes with increasing quantities of acetic acid, e. g. by 10 minutes in 135 when using four times the minimum. For double the quantity of acetic acid the difference is sometimes 5 minutes, but in several cases it was found to be negligible.
- 4) The viscosity decreases somewhat with increasing quantities of acetic acid, the difference not exceeding 0.10, however, even for four times the minimum amount, and often remaining near to within the limit of experimental error (0.20 to 0.03).

As in ordinary estate-practice great variations in the amount of acetic acid used for coagulation (e. g. half or double the ordinary quantity) will seldom or never occur, the use of acetic acid in practice will not form a factor causing important variation in the inner qualities of the rubber.

Economy in the use of chemicals of course necessitates the use of the minimum amount of acetic acid giving the desired coagulation within the desired time; but once this amount — which may differ for the method of preparation on different estates — is fixed, the small variations occurring in actual practice can not be the cause of lack of uniformity in the rubber.

IV. INFLUENCE OF THE AGE OF THE TREES ON THE QUALITY OF THE RUBBER. — Direct experiments to ascertain the influence of the age of the trees on the intrinsic properties of the rubber are practically impossible. In studying the qualities of rubber from the same group of trees over a long period, other factors in the cultivation, tapping system, planting distances, etc., nearly always vary, and in comparing rubber from different estates these same factors may play a — still unknown — rôle; with rubber from different fields of the same estate, factors such as method of preparation may completely confuse the result, if, for instance, the latex is not every day reduced to a standard dilution. Old trees generally produce a latex of higher rubber content than young trees and, it has been shown in a previous communication (See above, § II) what an important influence the rubber content of the latex has, notably on the rate of cure of the rubber.

By means of several special experiments and by carefully selecting the material at hand the writer is now able to state, however, that under similar conditions as regards rubber content of latex, method of coagulation and preparation, etc., the properties are as follows:

- 1) The tensile strength for older trees is not appreciably better than for young trees; in the case of young trees which had been in tapping for only a short time the writer has often found a lower tensile strength, without, however, being able to attribute this with certainty to the youth of the trees;

2) the slope or type of the stress-strain curve is mostly the same; sometimes it is somewhat better for old trees;

3) the rate of cure diminishes in an appreciable degree for old trees; the oldest trees in Java (plots of 35 and 40 years old) gave the slowest curing rubber of all;

4) the viscosity for old trees is nearly always better; for very young trees it is often below the average.

Attention is drawn to the fact that, in all these experiments, the rubber was made into crepe, as useable figures have not yet been obtained from rubber prepared as smoked sheet.

It is interesting to note that these results only partly confirm the opinion sometimes ventilated that rubber becomes better as the trees get older. The viscosity may be better from old trees, the slower and often much slower rate of cure might be considered as a less desirable property. In so far as young plantations do perhaps sometimes put on the market rubber of inferior quality, this may, at least partly, be due to the fact that older estates are as a rule better equipped and work more regularly, and thus produce a rubber which, in external as well as intrinsic qualities, is more uniform and regular. To this may be added the fact that young trees give a relatively small quantity of latex with a low rubber content, which may lead to greater dilution when the cupwashing is added to the latex, etc. When the latex is not brought to a standard dilution, these factors may even go so far as entirely to change the above named relative properties.

If the above mentioned fact, as to old trees giving a slow curing rubber, also holds good for the old trees in the primeval forests of Brazil, it may help to explain the rate of cure of Para-balls. This rubber, which when coagulated with acetic acid, as on estates, should vulcanise slowly owing to the age of the trees, develops without doubt a much greater rate of cure because the balls remain wet for such a long time, whilst on the other hand the smoking retards the vulcanisation somewhat, so that taken all together a rate of cure very much the same as that of plantation rubber would be the result, as is in fact mentioned in current literature.

It may be added that on an estate in Java (Sitoredjo near Semaraing), where the latex coagulated in the ordinary manner with acetic acid gives a crepe which cures in 100 minutes, an imitation of the Brazilian method gives balls with a rate of cure of 55-65 minutes. In the same way the latex from the old trees in Brazil, brought to standard dilution and coagulated with acetic acid, would probably give a slow curing rubber.

958 — **Researches on the Coagulation of Rubber, in Java.** — DE VRIES, O.: I. Sugar as a coagulant for crepe-rubber, in *Archief voor de Rubbercultuur in Nederlandsch Indië*, Year 1, No. 1, pp. 5-13. — II. Partial coagulation of latex, *Ibid.*, No. 3, pp. 178-184. Batavia, 1917.

I. — **THE USE OF SUGAR AS A COAGULANT FOR CREPE-RUBBER.** — The author gives the following summary of the results of experiments on coagulation of rubber by the aid of cane sugar.

Coagulation by the aid of cane sugar, as published by EATON (*Agric. Bull. F. M. S. IV*, 29), was taken up by the Besoekei and the West-Java Experimental Stations; the results of the former were only published at a planters' meeting, the latter issued a special Bulletin on the subject (GORTER and SWART, *Mededeelingen Rubberproefstation West-Java*, No 6, abstracted in *Agric. Bull. F. M. S. V*, 48). Several estates at the time when acetic acid was expensive made trials with this coagulant, and a large number of samples reached the Central Rubber Station for testing.

The result is that the difference between rubber coagulated by acetic acid and by sugar is insignificant. Tensile strength, slope (type after SCHIDROWITZ) and viscosity are nearly always the same, while in rate of cure a small difference is generally found, the sugar-coagulated rubber



curing slower or quicker as the case may be. This means that, with a running sale contract, the change from acetic acid to sugar would nearly always mean a change in the rubber delivered, which, unless warning were given, must be considered undesirable; but in general the small difference in rate of cure can form no objection to sugar as a coagulant, as the difference is well within the limits which are generally found for ordinary first latex crepe. In three series of experiments the uniformity from day to day (chiefly in respect to rate of cure) was not less with sugar-coagulation than with the ordinary acetic acid procedure.

Only one experiment as to the keeping qualities of sugar-coagulated rubber has terminated so far, and it showed no harmful influence from the sugar. Several experiments have been started, however, and results will be published in due time. GORTER and SWART (l. c.) have proved that, in coagulation with sugar, the same acids are formed that act in the slow coagulation with small quantities of acetic acid, so that a prejudicial influence on the rubber is not to be expected.

As the difficulties in the practice of sugar coagulation (discolouration or scum formation on the surface; incomplete or very slow coagulation when using bisulphite, and therefore a darker and sometimes uneven crepe) can be overcome, as is shown by the above mentioned publications, sugar might possibly be the coagulant most fitted to replace acetic acid in case of need.

II. — PARTIAL COAGULATION OF LATEX. — Partial coagulation of latex may be obtained by adding smaller quantities of acetic acid than for ordinary coagulation, by which, according to the quantity of acid used, after a shorter or longer time, a larger or smaller part of the rubber separates in clots after addition of more acid, or eventually after standing over night.

The separation of a first clot in this manner is, however, only possible with undiluted latex of about 30 % rubber content; diluted latex, say 15 %, does not show this phenomenon, or only with difficulty.

This procedure has been tried on several estates in Java, and was for a long time followed on a big estate in West-Java.

It was — and rightly — supposed that by partial coagulation the impurities and part of the non-rubber substances of the latex (resins, etc.) would be separated, giving as a second clot the greater part of the rubber in a much purer state. In fact the first clot, when forming not more than 25 % of the total rubber, is (prepared as crepe) of a high yellow or dark brown colour, whilst the second clot, even without the use of bisulphite, is very pale. Further it is possible, in following this method of preparation, to save acetic acid. It must be added, however, that the estate in question had to drop this procedure, as the brokers after some time declined to accept the "first clot" as first crepe rubber, and the pale second clot did not fetch a price which made this difference good.

Several series of samples, estate and experimental, have been tested, and the difference between first clot and the rest may be summarised as follows:



	First clot	Rest
Colour . . . . .	saffron-yellow to brown	pale
Ash, nitrogen and resins . . . . .	high	normal
Viscosity . . . . .	high	normal
Tensile strength . . . . .	low	high
Slope . . . . .	somewhat higher	normal
Rate of cure . . . . .	high	normal
Coefficient of vulcanisation for standard curve . . . . .	high	normal

This pronounced difference between a highly coloured and chemically impure, rapidly curing first clot with low tensile strength and high viscosity, against a pale second clot having nearly the ordinary properties of first latex crepe, is only obtained when the first clot constitutes 15 to, at most, 25% of the total quantity of rubber, which is attained by using 1 part of acetic acid in 450 to 600 parts of rubber, or less; sometimes even by using bisulphite only. By adding larger quantities of acetic acid at once, say 1: 250, a larger percentage (say 50 %) of the rubber may be obtained as first clot, but the difference in quality with the second clot than tends to disappear.

It may be remarked that the substances (oxydases) causing the violet surface-colouring of the coagulum also seem to be included for the greater part in the "first clot", as the first clot was often coloured by surface-oxidation, the rest remaining white.

As it might be supposed that the low tensile strength of the first clot was to be ascribed to particles of dirt, etc., this point was investigated further, and it was shown by carefully rewashing and recrepeing both clots that this is not the case:

	Tensile strength of	
	first clot	rest
Before rewashing . . . . .	1.42	1.50
After . . . . .	1.40 $\frac{1}{2}$	1.49

Extensive determinations were also made of tensile strength, and the tensile strength of the first clot was found to be smaller for all states of cure; this investigation will be published *in extenso* in another place.

CAMPBELL, some time ago (Bull. Ceylon No 27), expressed the opinion that with partial coagulation no marked differences are obtained either in time of cure or in physical properties. As will be seen, the writer came to an entirely contrary conclusion and noted very pronounced differences in all respects. This controversy is easily explained, as CAMPBELL added 1 part of acetic acid in 88 parts of rubber at once, separating a first clot

with the MICHIE COLLEDGE machine in 5 minutes, the rest being coagulated a few minutes later. As we have shown, even with smaller quantities of acid (1 : 225 to 1 : 300), the first clot obtained shows only slight or practically no difference from the second clot, and it is only in using acid in the proportion 1 : 450 or less that not more than 25 % of the rubber is separated as first clot and then shows the remarkable properties mentioned above.

959 - **Experiments to Prevent Rustiness in Sheet Rubber.** — ARENS, DR. P., in *Archief voor de Rubbercultuur in Nederlandsch-Indië*, 1st. year, No. 3, pp. 197-202. Batavia, 1917.

The author gives the following summary of his experiments on rustiness in sheets of the Hevea rubber.

The series of experiments were carried out on two different estates, on both of which 90 % of the sheets showed rustiness.

Rustiness is caused by certain components of the serum (probably proteids) exuding from the rubber after the sheets are rolled and forming a thin invisible film on the surface of the rubber, when the water evaporates. When the sheet is stretched this film is broken up into small particles, which look like a yellowish-brown powder. The experiments demonstrated that rustiness results if the sheets are hung to drip for a long time after passing the diamond rolls, and that it may be prevented by putting them in the smoking-house as soon as they are marked. The addition of sodium bisulphite did not give any result.

Brushing the sheets with cold water before putting them in the smoking-house proved to be ineffective, though the amount of rusty sheets was somewhat reduced in this way.

Sometimes, sheets which are smoked directly after rolling become "greasy". This may be prevented by keeping the sheets under water for a night.

960 - **Investigation of the Methods and Costs of Marketing Butter in Kansas.** — MACKLIN, THEODORE, in *Kansas State Agricultural College, Agricultural Experiment Station, Bulletin* No. 216, pp. 1-80. Topeka, Kansas, April 1917.

During a period of 18 months the Kansas State Agricultural Experiment Station made a thorough investigation of the methods, processes and costs of marketing butter made both on farms and in creameries of the state. Creameries reported the complete facts of their business for more than three-fourths of the Kansas creamery butter made during the period of study, while representative farmers and stores gave accurate facts concerning their respective operations. The facts concerning the progress of Kansas dairying were obtained from numerous library sources and from pioneer Kansas dairymen. A summary of the investigation presented in this bulletin in 32 Tables and 42 diagrams and charts, brings forward the following facts and conclusions both of local and general interest :

1) Dairy farming in Kansas has been, and continues to be, a side line on the average farm. Experience with whole-milk creameries, local private creameries, and skimming-station centralizers proved that they were not adapted to local conditions, and led to the establishment of cream-station



and direct-shipper centralizers which are well adapted to the conditions of Kansas dairy farming.

2) Farm butter-making has rapidly declined in Kansas owing to the rapid increase in the efficiency of creameries. Nevertheless, there are many who make farm butter.

Those who sold the largest quantities obtained the best prices. Quality of farm butter depends upon specialization, which in turn is warranted only when a large quantity can be made and sold. Only those who lived close enough to favourable markets found it worth while to make large amounts of farm butter.

3) The average farmer does not live close enough to favourable markets to make and market butter profitably, except in so far as the stores follow the practice of paying the same price for both good and poor butter.

4) Kansas has 78 creameries; 41 are centralizers which make more than ninety-five per cent. of the creamery butter of the state. Only one-third of the creameries make annually 10 000 pounds of butter or more each. Centralizers are necessary because there is only one creamery for each 1053 square miles, and the average farmer lives 19 miles from a creamery. This is too great a distance to drive, so that cream shipment is the farmer's economical choice.

5) The average creamery patron in the state sells less than one quarter of a five-gallon can of cream per week. He finds it more profitable, therefore, to sell to the cream station at the cream station prices, than to ship direct and deduct from the delivered price, the expense of shipping a partly filled can. It is the small amount of butterfat supplied by the average creamery patron which accounts for the fact that 2020 cream stations deliver four-fifths of the butterfat from the farmer to the creamery. The few farmers who produce sufficient cream to justify direct shipment are following this method.

6) The prices paid for delivered butterfat by centralizers averaged above Elgin prices, and according to prevailing economic conditions appear to be fair. The fact that butterfat prices in Kansas are somewhat lower than in some other states is because farmers choose to sell four-fifths of their butterfat through cream stations rather than to deliver the cream at their own expense. The difference between prices paid to farmers in Wisconsin and in Kansas, for example, was due to the difference in cost of getting butterfat from the farm to the creamery in the two states. Kansas farmers, because they lived 19 instead of 5 miles from a creamery, on an average pay 3.46 cents to deliver their butterfat.

7) More and better dairy cows would have the effect of reducing the cost of getting butterfat to the creameries, of lowering the cost of making and marketing butter by the creameries, and would result in higher net prices and greater profits to the farmer.



## PLANT DISEASES

### DISEASES NOT DUE TO PARASITES OR OF UNKNOWN ORIGIN.

962 - "Gummosis" of the Sugar-Cane in Java. — GROENEWEGE, J., in *Archief voor de Suikerindustrie in Nederlandsch-Indie*, Pt. 16, pp. 597-638, pl. I-IX. Soerabaja, 1917.

"Gummosis" of the sugar cane is found all over Java, and but few varieties are immune. The disease is closely connected with the use in the plantations of cuttings with soft bark which rots easily. The products of putrefaction, besides preventing the growth of the plant, cause lesions on the roots and are the real cause of infection.

The danger of infection is greatest during the dry season and in light soils.

There is no danger of spreading the disease by cuttings from an infected plantation, as the presence of *Bacterium vascularum* alone is not sufficient to infect healthy plants.

The disease may be prevented by the use of cuttings with hard bark, which are more resistant to rotting. Cuttings with one node only should never be used. The application of tar and Bordeaux mixture gave negative results.

963 - The Treatment of Sugar-Cane Cuttings with regard to "Sereh" Disease and Disease of the Phloem in Java. — VAN HARREVELD, PH., in *Archief voor de Suikerindustrie in Nederlandsch-Indie*, Pt. 15, pp. 557-589. Soerabaja, 1917.

The question of the supply of sugar-cane cuttings has recently attracted general attention. There is a demand for a cooperative mountain plantation which will produce cuttings of the types and varieties required by growers.

The author, who is the Director of the Sugar-Cane Experiment Station of Pasoeroean (Java), does not see in this measure a radical solution of the problem, and again discusses the question of cuttings in relation to the diseases mentioned. The results of his studies led to the following conclusions.

When a variety of sugar-cane is attacked by "sereh" in certain plantations in the plain, and the disease spreads, it is necessary that cuttings grown in the mountains be introduced.

The possibility of propagating these cuttings in special plantations in the plains depends on the extent of the disease. In order to judge the degree of susceptibility to the disease a special inspection of the plantation is imperative.

It is impossible to draw up any programme for the supply of cuttings; a method efficacious for one plantation may be very costly for another. It is necessary to keep an exact record of all the results obtained from imported mountain cuttings, and especially of the productions obtained.

As soon as disease of the phloem appears, cuttings of a variety grown at a height of 2500 or 3000 feet during several generations should be obtained. Such cuttings may be propagated in special plantations at a lower altitude.

All these measures have already been carried out for many years at Java, and though a special, cooperative plantation is much to be commended, new results must not be expected from it. Moreover, it would be impossible to limit it to cuttings newly imported from the mountains; only the production of new varieties being capable of allowing a decrease in importation and expense.

A certain number of experiments with the new varieties in the plantation is the only means of ascertaining their qualities. Such experiments are already being carried out on a large scale in Java.

#### DISEASES DUE TO FUNGI, BACTERIA AND OTHER LOWER PLANTS.

964 - **The British Species of *Phomopsis*.** — GROVE, W. B., in *Royal Botanic Gardens Kew, Bulletin of Miscellaneous Information*, No. 2, pp. 49-73, Pl. I-II. London, 1917.

GENERAL

The revision in 1916, of the large number of British specimens preserved in the Herbarium of Kew, under the genus *Phoma*, has revealed the existence in Great Britain, of a large number of species belonging, not to the genus *Phoma*, but to the genus *Phomopsis*. A list of these species arranged alphabetically is given here; the name of each being followed with some morphological or critical notes. The localities are only given when the species has not been previously recognised as British. Complete descriptions will appear in a work which is now in course of preparation.

Among the *Phomopsis* mentioned are:

- 1) *Ph. ambigua*, Trav., on twigs of *Pyrus communis*; possibly also on *P. malus*. The pycnidium of *Diaporthe ambigua*, Nits.;
- 2) *Ph. Amelanchieris*, Grove, on branches of *Amelanchier*;
- 3) *Ph. Celastrinae*, Grove, on twigs of *Euonymus americanus*;
- 4) *Ph. cinerascens*, Trav., on the branches of *Ficus Carica*. The pycnidium of *Diap. cinerascens* Sacc;
- 5) *Ph. cistina*, Grove, on branches of *Cistus laurifolius*;
- 6) *Ph. Corni*, Trav., on twigs of *Cornus alba*, associated with *Diap. Corni*, Fckl.;
- 7) *Ph. cryptica* v. Höhn, on branches of *Lonicera* in Cheshire. The pycnidium of *Diap. cryptica* Nits.;

- 8) *Ph. exul*, Grove, on twigs of *Maclura aurantiaca* ;
- 9) *Ph. japonica* on twigs of *Kerria japonica*. The pycnidium of *Diap. japonica* Sacc. ;
- 10) *Ph. juglandina* v. Höhn., on bark of trees of *Juglans regia*. The pycnidial stage of *Diap. juglandina*, Nits. ;
- 11) *Ph. Landeghemiae* v. Höhn., on twigs of *Philadelphus coronarius*. The pycnidium of *Diap. Landeghemiae*, Nits. ;
- 12) *Ph. Lebiseyi*, Died., on branches of *Negundo aceroides*. Pycnidium of *Diap. Lebiseyi*, Niessl. ;
- 13) *Ph. Lysimachiae*, Grove, on stems of *Lysimachia vulgaris* ;
- 14) *Ph. Malvacearum*, Grove, on stems of *Malva moschata* ;
- 15) *Ph. Mulleri*, Grove, on branches of *Rubus fruticosus*, and *R. Idaeus* ;
- 16) *Ph. nitidula*, Grove, on stems of *Scrophularia nodosa* ;
- 17) *Ph. occulta*, Trav., on scales of cones of *Picea excelsa*, at Malvern and Dolgelly. The pycnidium of *Diap. occulta*, Nits. ;
- 19) *Ph. Platanoides*, Died., on twigs of *Acer pseudoplatanus* ;
- 18) *Ph. Prunorum*, Grove, on twigs of *Prunus Laurocerasus* and *P. lusitanica*. Possibly the pycnidium of *Diap. viridarii* Sacc. ;
- 20) *Ph. pterophila*, Died., on samarae of *Fraxinus excelsior*, but only on the thick part enclosing the seed, not on the wing. Pycnidium of *Diap. samaricola*, Phill, and Plow ;
- 21) *Ph. quercella*, Died., on twigs of *Quercus* ;
- 22) *Ph. quercina* v. Höhn., on branches of *Quercus* at Malvern ; Considered to be the pycnidium of *Diap. leiphaemia* Sacc. (*Valsa leiphaemia* Fr.) ;
- 23) *Ph. Robergeana*, Died., on twigs of *Staphylea pinnata* ; probably the pycnidium of *Diap. Robergeana*, Niessl. ;
- 24) *Ph. Rosae*, Grove, on prickles of *Rosa canina* ;
- 25) *Ph. rudis* v. Höhn., on twigs of *Laburnum* ; pycnidium of *Diap. rudis* Nits. ;
- 26) *Ph. Ryckholtii* v. Höhn., on branches of *Symphoricarpus racemosus*. The pycnidium of *Diap. Ryckholtii* Nits. ;
- 27) *Ph. salicina*, Died., on branches of *Salix babylonica*, *S. viminalis*, and other species ;
- 28) *Ph. sambucina*, Trav., on twigs of *Sambucus nigra*. The pycnidium of *Diap. circumscripta* Otth. ;
- 29) *Ph. scobina* v. Höhn., on twigs of *Fraxinus excelsior*, frequently accompanied by *Diap. scobina* Nits., of which it is the pycnidium ;
- 30) *Ph. striaeformis*, Grove, on twigs of *Kerria japonica* ;
- 31) *Ph. velata*, v. Höhn., on bark of *Tilia* spp. The pycnidium of *Diap. velata*, Nits. ;
- 32) *Ph. viridarii*, Grove, on twigs of *Magnolia grandiflora*.

There follow some species excluded for the present from the British list.

965 - New Japanese Fungi. — TANAKA, TŌZABURŌ, in *Mycologia*, Vol. IX, No. 3, pp. 167-172 and No. 4, pp. 249-253, Lancaster, Pa., 1917.

The writer proposes to supply American and European phytopathologists, by means of a series of papers prepared for the purpose, with prompt



and full information regarding newly discovered Japanese fungi that have been described only in Japanese.

The descriptions given in the two papers analysed (which are the first of the series), are taken from different Japanese publications which appeared in 1915 and 1916.

As regards the Japanese fungi discovered before those dates, there are 2 lists: one is by PROF. J. MATSUMURA (*Index plantarum japonicarum*, Vol. I. *Cryptogamae* [Fungi, pp. 127-184], 8°, Tokyo, 1904) and gives in alphabetical order the species with synonymy, host plants and localities, all in Latin; the other by PROF. M. SHIRAI (*A List of Japanese Fungi hitherto Known*, 156 pp., 8°, Tokyo, 1905), giving an alphabetical list of species with synonymy in Latin and the host plants in Japanese characters only. Localities are not given.

The more important fungi causing plant disease in Japan are treated of by PROF. A. IGETA (*Handbook of the Plant Diseases of Japan*, 4th. ed., 1104 pp., 4°, Tokyo, 1909-1911). A 17-page index gives the Latin names of the fungi described. Prof. IGETA is now writing a supplement bringing this work up to date.

After this preface, we now give a list of the species of which the writer reproduces the descriptions.

1) *Valsa* (*Euvalsa*) *Paulowniae*, Miyabe and Hemmi sp. nov. (in *Journal of Plant Protection*, published September 1916). This fungus attacks the *Paulownia* tree first on the twigs, and spreads over the branches, finally covering the entire trees down to the roots. The infection occurs in winter and early spring, mostly on the wounded, or dead, parts of shoots, which gradually become rough, dry and brown and finally crack, while irregular elevated spots appear on the surface, these being the stromata of the fungus. This "Tachigare", or dieback disease, first appeared in Hokkaidô about 1910 and seriously damaged *Paulownia* first in 1913 and 1914, when many old trees were killed. In 1915, the disease spread all over Hokkaidô, and in one case, about 3000 trees at the same place were attacked. For its prevention, the trunks of the trees should be wrapped in straw in winter, so as to prevent freezing or wounding. The trees should be sprayed with Bordeaux mixture in early spring.

2) *Ophiochaeta graminis* Sacc., H. Hara n. comb. (May 1916). This fungus, commonly called *Ophiobolus graminis* Sacc., is known as the cause of foot-rot of wheat and barley in France, Belgium, Germany and Japan (1). Hara, who discovered a similar disease on rice, proposes to transfer it to the genus *Ophiochaeta* on account of the existence of bristle hairs

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(1) This parasite has also been recorded in different regions of Italy as causing severe damage, not only to wheat and barley, but also to rye and oats. It has also been found on *Agropyron* sp., and is known in England under the name of straw blight. The fungus does much injury to wheat in Australia, where it has also appeared on *Bromus sterilis*. Cfr. FERRARIS T., "I parassiti vegetali delle piante coltivate od utili" 2nd. ed., pp. 436-439. Milan, Hoepli, 1915; MASSEE G., "Diseases of Cultivated Plants and Trees", pp. 226-227. London, Duckworth and Co., 1910. (Ed.)

on the perithecium. He suggests the following factors in preventing the disease: selection of a resistant variety; necessity of avoiding the use of too much nitrogenous fertiliser; not allowing too much water on the field; the application of farmyard manure.

3) *Marssonina Carthami* T. Fukui, sp. nov. (June 1916); on living leaves of young plants of the Composite *Carthamus tinctorius* L. (Called "Benibana" in Japanese and "Hung-hud" in Chinese), at Abegun, Shidzuoka-ken, Japan.

4) *Mycosphaerella Hordicola* Hara sp. nov. (July 1916). On the blades and culms of wheat, barley and naked barley (*Hordeum trifurcatum* Jacq.). Its distribution is as follows: Ukushima-mura (1913); Inasagun, Jinoyamura; Aratama-mura (1914); Fuji-gun, Obuchi-mura (1915); Agehara-mura, Shidzuoka-ken, Suntô-gun, Kanoacka-mura (1916). Local names of the disease; "Mugi no Tachigare", "Kuse": new Japanese name "Mugi no Kangarebyô". A barley variety "Dobu" seems resistant to the disease; on the other hand "Oku-mikawa" is very susceptible. The disease is much less injurious when seeds are sown earlier than the usual planting time. It becomes virulent when nitrogenous fertilisers are used too freely. Phosphates are effective in strengthening the growth of the culm to withstand the disease. Lime, flowers of sulphur and Bordeaux mixture all lessen the damage done by the parasite.

5) *Scorias capitata* K. Sawada sp. nov. (February 1915), on the upper surface of the leaves of *Thea sinensis* L., sometimes covering also the lower surface and, even the twigs, at Taihokuchô Chonaihô-shô (Formosa), in December 1907.

6) *Zukalia Theae* K. Sawada sp. nov. (February 1915) on leaves and twigs of *Thea sinensis* at Shinchiku-chô, Sanshaka, Formosa, in May 1910.

7) *Zukalia nantoensis* K. Sawada sp. nov. (March 1915) on leaves of *Thea sinensis*, at Nantô-chô, Gyochi, Taiwan (Formosa) in October 1907, and at Nantô-chô Shinjô, Taiwan (Formosa), in October 1915; this fungus causes the disease of the tea plant called Susu-byô (Sooty mould disease) in Formosa and mostly occurs with *Z. theae* K., *Scorias capitata* K., and *Capnodium Footii* Berk. and Desm.

8) *Pestalozzia Theae* K. Sawada sp. nov. (February 1915) on leaves of *Thea sinensis*; the diseased spots are brown when young, but when mature, become grey with a brown margin. They are usually 1 cm. in diameter, sometimes covering half a leaf. Type localities: Taihokuchô Zuihô (1909); Taihokuchô Kusshaku; Taihokuchô Mokusaku; Taihokuchô Shinten; Taikokuchô, Rigyokutsu (1908); Taihokuchô, Hokuseiko (1907); Taihokuchô Chonaihô (1908, 1909, 1910); Tôenchô Kessishô; Tôenchô Dôraken; Tôenchô Anheichin (1908); Shinchikuchô Shinpo; Akôchô Kôkô (1910).

9) *Sclerotinia Fagopyri*, S. Hori sp. nov. (March 1916). The sclerotia form inside the seeds of *Fagopyrum esculentum* Moench, and probably germinate twice a year.

10) *Phytophthora Allii*, K. Sawada sp. nov. (March 1915), on the leaves and flower stalks of *Allium fistulosum* at Taihoku-chô Chônaiho-shô, Taiwan (Formosa) in February and July 1913. An attempt to inoculate the



ordinary onion with this fungus was not successful; the only plant susceptible to the disease inoculation test was *Epiphyllum truncatum* Haw. The disease is not at present widely distributed and the injury not very serious.

11) *Phyt. Melongenae* K. Sawada sp. nov. (March 1915), on the fruits of the egg-plant (*Solanum Melongena*). All the Japanese varieties of *S. melongena* are susceptible to this disease, and in one case 60 to 70 per cent. of the crop was lost. Inoculation tests proved that the disease can be produced in tobacco, tomato, potato, figs, *Areca Catechu*, *Hibiscus esculentus* and, in a lesser degree, on *Epiphyllum truncatum* and *Ricinus communis* L.

12) *Massaria phorcioides*, I. Miyake sp. nov. (December 1916), common on twigs of *Morus alba* on which it is probably parasitic. This fungus is found throughout China and Japan. Type localities: Gifu-ken (prefecture) Kaidzu-gun Kaisai-mura; Fukuiken (prefecture), Tsuruga and Yamagata-Ken (prefecture), Yamagata-shi (1915); Akita-Ken (prefecture) Akita-shi, and Otate-chô, Iwateken (prefecture) Fukuoka-chô and Kyôto-fu (prefecture), Ayabe-chô (1915).

13) *M. mori*, I. Miyake sp. nov. (December 1916), on twigs of *Morus alba* at Akita-Ken (prefecture) Yuzawa-chô (March 1915), and at Kyôtofu (prefecture) Ayabe-chô (April 1915).

966 - Vegetable Parasites Observed on Cultivated Plants in the Dutch East Indies. — See No. 978 of this Review.

967 - The Acidifying Action of the Basidiomycete *Coniophora Cerebella* on Timber. — PETRI, L., in *Annali del R. Istituto superiore forestale nazionale*, Vol. II (1916-1917), pp. 433-447, figs. 1-2. Florence, 1917.

The investigations of MÖLLER, FALCK and SCHAFFNIT have shown that, of all the fungi capable of determining a primary infection of timber, *Coniophora cerebella* A. and Sch. is without doubt the most widespread. These primary infections, which cause dry rot, later lead to secondary infections by other fungi, among which is *Merulius lacrymans*, thus causing the complete destruction of the wood.

The results of experiments on this subject lead FALCK to the conclusion that the predisposition of wood to attacks by *Merulius* in the case of spore infection, is determined by the acidification of the medium by *Coniophora* and other fungi.

WEHMER opposes this opinion, and considers that, very often, the growth of mycelium on unsterilised wood or the germination of *Merulius* spores, are inhibited by saprophytic bacteria or fungi which multiply by fission, and thus develop in spite of the low acid reaction of the wood; this action is still more marked if the wood is neutralised by alkalis or alkaline salts. The favourable influence of acids on the germination of *Merulius* spores probably consists precisely in the fact that it inhibits the concurrence of other non-acid microorganisms.

This discussion is of practical interest where the treatment of wood is concerned, since it seeks to determine whether infection by *Merulius* can be caused by spores or only by contact with wood which is already diseased.

If, as WEHMER thinks, the natural acidity of wood is not sufficient to



protect the mycelium derived from the spores against the antagonistic action of schizomycetes or fungi which multiply by fission, all danger of the spread of infection by spores is removed, or, at least, must be very rare. If, on the other hand, as FALCK thinks, dry rot, or any other action of microorganisms, by increasing the natural acidity of the wood, assures the germination of the spores and the growth of the resulting mycelium, infection by spores constitutes a great danger.

A first series of experiments undertaken by the author for the purpose of clearing up this question showed that *Con. cerebella* can have an acidifying action of wood. This acidification, which is very slight, is due to oxalic acid (potassium acid oxalate); it is subordinated to the rate of growth of the mycelium and to its metabolism.

The superficial growth of the mycelium alone, without subsequent destruction or alteration of the constituents of the cell walls, does not determine an increase in acidity, but gradual and continuous oxidation, especially of the tannic acid, by the action of the oxidases, causes a decrease in the original acidity. This same fact may be verified in the case of wood which has been strongly attacked and altered, if cultivation is prolonged beyond a limit, which varies in different woods, and depends on the quality and quantity of the food at the disposal of the mycelium.

It may happen that the same wood attacked by *Coniophora*, but analysed at various periods, shows an increase or a decrease in the original acidity. These variations must be taken into consideration when studying the conditions rendering wood susceptible to attack by *M. lacrymans*.

The *Coniophora* mycelium, developing on wood, has no antagonistic action against many species of ordinary bacteria and moulds (*Penicillium*).

The investigations are to be continued.

MEANS  
OF PREVENTION  
AND CONTROL

968 - **Patents Relating to the Control of Plant Diseases and Pests.** — See No. 947 of this Review.

969 - **A New Disease of Wheat, Probably of Bacterial Origin.** — SMITH, ERWIN, F., in the *Journal of Agricultural Research*, Vol. IV, No. 1, pp. 51-53, pl. 4-8. Washington, D. C., 1917.

Preliminary notice is given of a disease of *Triticum* spp. which has appeared in various parts of the United States of America. It was first observed in 1902 on wheat from Indiana, being considered as probably of bacterial origin. It was again found, in 1915, in large quantities of material from Kansas and Indiana. In 1917 the disease was observed in Texas, Oklahoma, Kansas, Arkansas, Missouri and neighbouring states.

The disease is being fully studied in the Washington Plant Pathology Laboratory in collaboration with the Kansas and Wisconsin Experiment Stations.

The disease is characterised by the appearance of black, longitudinal, parallel stripes of varying depth, on the glumes of the wheat when it is nearing maturity. The stripes are usually more numerous and marked on the upper parts, where they often fuse; they frequently reach to the base of the glume. Inside, in the parts corresponding to the stripes, the glumes

DISEASES  
OF VARIOUS  
CROPS

have black or brown spots, invaded by bacteria ; in some cases fungi are also found. In bearded wheats the awns are often attacked and discoloured, at least at their base. In the advanced stages of the disease the rachis and culm are covered with black or brown streaks. The leaves too are attacked. When the disease is serious the caryopses appear very shriveled, and, sometimes, there are cavities filled with bacteria in them. As the ears are stunted and the caryopses considerably shriveled, there is a corresponding reduction in yield.

For next autumn, only seed from fields known to be free from this disease should be used, and no manure should be used derived from animals whose food or litter contains straw attacked by it. Such manure should only be used on fields in which neither wheat nor other cereals are grown. Animals fed on the straw of the diseased wheat should be kept away from fields in which wheat is to be grown.

970 - *Ustilago nuda* and *U. Triticci*, Observed Respectively on Barley and Wheat in Java. — VAN HALL, C. J. J., in *Teysmannia*, Year XXVIII, No. 1, pp. 24-27. Batavia, 1917.

For some time past interest in the cultivation of wheat has been renewed in Java. With the help of the Department of Agriculture experimental plots have been set out and it is proposed to introduce large quantities of seed wheat into the Island.

Although cultivation has started so recently, diseases of cereals have already appeared in the Dutch Indies ; chief amongst them are smut of barley (*Ustilago nuda*) and smut of wheat (*U. Triticci*).

The way smut was brought into the island shows how easy it is to introduce a disease by means of seeds. In 1915, horses for the army arrived from China. While on board they were fed on barley, and a small quantity of this cereal came with the horses to the army deposit. Without any specific end in view a little of this barley was sown at Padalarang, where the horse-deposit is ; shortly after the plants were attacked by *U. nuda*. It should be noted that barley is cultivated in no other part of Java.

In 1916, the Department of Agriculture obtained seed wheat from India and Europe. The plants from these seeds were attacked by various diseases, amongst them smut.

Special attention is drawn to these facts, and the urgency of disinfecting the seed by treatment with hot water (JENSEN'S method) is insisted on.

971 - *Septoria Persicariae* n. sp., a new Leaf-Spot Disease of *Polygonum Persicaria* in Utah, United States. — O' GARA, P. J., in *Myrologia*, Vol. IX, No. 4, p. 248, plate 10, Lancaster, Pa. 1917.

The writer describes, as a species new to science, *Septoria Persicariae* which is parasitic on the living leaves of *Polygonum persicaria* L., producing conspicuous spots upon the upper and lower surfaces. These spots, which are nearly circular, are from 1 to 8 mm. in diameter ; they occur either separate, or united, and are at first rusty brown in colour. Later, they become brownish grey or grey towards the centre, being surrounded with a narrow purplish-red or violet border.



The fungus, which is represented by a small number of specimens, was found in July 1914 and August 1916 by Mr. W. W. JONES in Salt Lake Valley.

972 - *Bacterium citrarefaciens*, sp. nov., the Cause of the Disease of Orange and Lemon Trees known as "Citrus Blast" in California. — LEE, H. ATHERTON, in *Journal of Agricultural Research*, Vol. IX, No. 1, pp. 1-8. plates A, 1-2. Washington, D. C., 1917.

Since 1912, a disease of orange and lemon trees has repeatedly been recorded in north and central California. In 1916, Dr. J. E. COTT, finding no similar disease described in scientific literature, gave it the name of "citrus blast".

The disease is first noticed during the rainy season of California, usually about the middle of January. Young leaves are found to be dropping off, sometimes leaving whole branches bare. On examining more closely, black, discoloured areas are noted on the leaves; such areas are found most commonly at the junction of the leaf blade and the wings of the petiole. The affected parts have a water-soaked appearance, and the whole leaf loses its rigidity and hangs limply from the branch. Less commonly, such water-soaked lesions appear near the tips of the leaves.

The blackened areas frequently spread down the petioles of the leaves into the twigs upon which the leaves are borne. If such a twig is young and actively growing, the diseased area spreads quickly, and the whole twig becomes black and shrivelled. The disease has never been found spreading down into the mature wood.

In California, there occur in March, periods of several days in which the weather becomes very warm, and the orchards dry up to some extent. Such weather causes the affected tissues at the base of the leaf blade and the affected leaf petioles to dry up, become rigid, and the leaves to droop.

In many cases, the lesion spreads from the petiole of a leaf down into the twig tissue which is still soft, but not actively growing, and a small black area is formed round the base of the petiole. After the leaf has dropped off, and the dry season begins, brown blister-like scabs are formed over such affected areas. As the twig continues growing, these scabs become loose and may be cast off the following autumn. On trees which have been affected in the spring, however, such blisters are frequently found in the succeeding winter, and these are presumably the sources for the dissemination of the disease.

On January 24, 1916, fresh material of "Citrus blast" was sent from Palermo, Cal. Sections through the lesions were made and the tissues were seen to be filled with motile bacterial organisms. On isolation plates, bacterial colonies were obtained which, on inoculation into orange trees in the greenhouse, produced the typical lesions of the disease. From such positive inoculations the organism has been re-isolated and re-inoculated, again giving positive results, after which it was again isolated.

This bacterium is a distinct species new to science, and is described in detail under the name of *Bacterium citrarefaciens*. It lives in the parenchyma destroying the cell structure and leaving large pockets filled with



bacterial masses. The microorganism does not ordinarily invade the vascular bundles and is apparently restricted to the parenchyma.

The disease causes a decrease in leaf surface and a loss of the fruit-bearing wood in orchard trees.

Young trees in nurseries may also be injured.

973 - Studies on the "Ink Disease" of the Chestnut Tree in Italy (1).—PETRI, L., in *Annali del R. Istituto superiore forestale nazionale*, Vol. II (1916-1917), pp. 219-399, figs. 1-14, pl. II-V. Florence, 1917.

This report gives the results of numerous investigations carried out since 1907 in the provinces of Novara, Lucca, Pisa, Florence and Rome.

The specific infection causing "ink disease" in the chestnut tree is localised in the cambium at the base of the main roots and neck till just above the surface of the ground.

The parasite consists of a multicellular mycelium, which, however, may remain unicellular during a more or less long period of time; reproduction is intercellular and intracellular, but, at present the organs of reproduction are unknown both in the cambium and in the most varied artificial media. In the cambium it forms globular and thread-like haustoria.

Infection is usually caused by direct contact of healthy roots with infected material. The mycelium may enter through superficial wounds, tumours of the bark, or small places where the peridermis has already been partly softened by the action of other weak parasitic microorganisms. Once the cambium is attacked, the mycelium spreads more or less rapidly in that of the largest roots, the neck, and the lowest part of the stem. The death of the plant follows on the complete infection of the cambium of the neck.

In most cases the disease caused by the specific infection is complicated by one caused by dry rot of the heartwood, which spreads in a centrifugal direction and is produced by various polypori. After the cambium has died the sapwood is usually invaded by a large number of saprophytic fungi which generally come from the diseased heartwood. The progress of the parasitic mycelium along the cambium is closely followed by these saprophytes, which also invade the bark. These facts, together with the rapidity with which the specific agent of the disease disappears after the death of the tissues in which it developed, explain the difficulty of determining the true cause.

The same phenomena occur at the base of the main roots. The secondary infection which spreads from the neck to the free parts of the roots must be clearly distinguished from the primary infection which results from a direct attack of the specific parasite. In the first case, the disease spreads from the interior to the exterior, till the "ink stains" appear on the bark ("secondary stains"). In the second case, the black rot passes from the exterior to the interior on roots whose sapwood and heartwood are perfectly healthy ("primary stains").

(1) See also R., April 1917, No. 387.

(Ed.).

An impermeable subsoil, abundant clay, a damp and warm position sheltered from north winds, all render chestnut trees susceptible to this disease. Attacks on the trunk by *Polyporus sulphureus* do not in any way render the tree more susceptible to the disease, on the contrary, trees invaded by this polyporus are much less liable to "ink disease". This must be explained by the different physiological requirements of the specific parasite of the disease and of *P. sulphureus*. Whereas the former requires tissues rich in water, the latter prefers the heartwood, very poor in water, of chestnut trees which, owing to their position, often suffer from drought.

Weak parasites may attack the branches when infection of the cambium, the neck, or some of the main roots has already set in. These mycoses of the leaves often aggravate the symptoms of decay due to the disease, but are not of necessity a complement to it.

*Coryneum perniciosum* Br. and Farn. is the most virulent of these parasites, and finds particularly favourable conditions in chestnut trees which are already suffering from "ink disease" or ordinary root rot. Young chestnut trees, whose trunks have a soft peridermis may be attacked either on a level with the soil or just above it, and may be killed in a few days by *C. perniciosum* when the specific cause of "ink disease" is already present in the neck.

Attack by *Coryneum* therefore never forms an independent specific disease, but is a complementary disease subordinate to an alteration of infectious origin in the roots and the neck.

The European forms of *Endothia radicalis* or similar parasites, have almost the same effect as *C. perniciosum*, although their action resembles that of wound parasites.

The most certain characteristic for the diagnosis of sick plants lies, not only in the black rot of the roots, but in the longitudinal patches of brown in the cambium of the stem, ending at the top, in a point a little above the level of the soil.

No definite results have yet been obtained from the experiments on the improvement of chestnut plantations with resistant stock plants. In the meantime it is advisable to destroy and isolate all infected areas as soon as the existence of the disease is established.

A bibliography of 95 works is appended.

974 - New Species of *Peridermium* on *Pinus* in the United States. — HEDGCOCK, GEO., G. and HUNT, N. REX, in *Mycologia*, Vol. IX, No. 4, pp. 239-242. Lancaster, Pa., 1917.

A systematic description of the following uredineae:

1) *Peridermium ipomoeae*, sp. nov., the aecidial form of *Coleosporium ipomoeae* (Schw.) Burrill, collected on the needles of *Pinus echinata* Mill. (Alabama, Arkansas, Georgia, North Carolina, South Carolina, Texas and Virginia), *P. palustris* Mill. (in Florida and South Carolina), *P. rigida* Mill. (in Georgia, Maryland, Pennsylvania and South Carolina) and *P. Taeda* L. (in Alabama, Arkansas, Florida, Georgia and South Carolina);

2) *Per. terebinthinaceae*, sp. nov., the aecidial form of *Coleosporium erebinthinaceae* (Schw.) Arthur, collected on *P. echinata* (in Alabama,

Georgia, North and South Carolina) and *P. Taeda* (in Alabama); a form which may be this species has been collected on *P. pungens* Michx. f. (Georgia) and on *P. virginiana* Mill. (North Carolina);

3) *Per. Helianthi*, sp. nov., the aecidial form of *Coleosporium Helianthi* (Schw.) Arthur, collected only on *P. virginiana* (Pennsylvania, North and South Carolina, Tennessee, West Virginia and Virginia), but it probably will be found later on *Pinus echinata*;

4) *Per. fragile*, sp. nov., on *P. palustris* (Florida and Georgia), *P. Taeda* (Florida), and *P. rigida* (New Jersey);

5) *Per. minutum*, sp. nov., on *P. glabra* Walt. and *P. Taeda* (Florida).

## INJURIOUS INSECTS AND OTHER LOWER ANIMALS.

975 - **Observations on British Coccidae** (1). — GREEN, E. ERNEST, in *The Entomologist's Monthly Magazine*, Vol. LIII (Third Series, Vol III) No. 33 (No. 640), pp. 201-210, fig. 1-4. London, September 1917.

GENERAL

The writer treats in his paper of the following *Coccidae*:

1) *Lecanium bituberculatum* Targ., a species occurring abundantly on a small section of hawthorn hedge in Camberley (March 26, 1917);

2) *L. capreae* L. Dr.; IMMS sent the writer an example of this coccid taken upon *Myrica gale* at Pwllheli, Carnarvon. The writer also received the same insect on *Cerasus Laurocerasus* (= *Prunus Laurocerasus*) from Woking where it was found by Mr. H. D. TAYLOR. Both plants constitute new records for the species;

3) *L. nigrum*, var. *depressum* Targ., especially abundant on the under-surface of the fronds of a species of *Musa* and occurred more sparingly on *Chrysophyllum Malacantha* and *Ficus* spp., in the palm house of the Royal Botanic Gardens, Kew (in December 1916);

4) *L. persicae crudum* n. subsp. on leaves of *Aralia*;

5) *L. hesperidum* L. var.; Dr. IMMS has submitted specimens of this coccid which had been found on an orange plant raised from seed in the Botanical laboratory at Manchester University;

6) *L. signiferum* Green, on *Polypodium aureum* in a plant house at the Royal Botanic Gardens, Kew (December 1916);

7) *L. zebrinum* n. sp., on branches and young stems of *Betula alba*, more commonly on sapling plants; also on sapling *Populus tremula* at Camberley (May-June 1917). An adult male emerged on June 2; young larvae escaped from beneath the scales on June 22. The females are extensively parasitised by two different species of Chalcids. The new species of coccid is very closely related to *L. ciliatum* Douglas, which occurs on oaks;

8) *L. transvittatum* n. sp., on *Betula alba* at Camberley (June 1917). This species seems to be extremely scarce, many hours of diligent search having resulted in the discovery of only 4 individuals. Of these, 3 were found on

(1) See also *B.* August 1915, No. 867; *R.*, June 1916.

(Ed.)



the lateral branches of sapling trees of *B. alba* and the fourth on a small branch of an older tree. Young larvae commenced to appear on June 23;

9) *Lecanopsis longicornis*, Green. This species was described from 3 examples taken in 1915. The insect was afterwards found in comparative abundance on *Carex ovalis* in damp meadows, near Camberley (July 1916). Young larvae were emerging on July 18;

10) *L. bulleri* n. sp. This new species was first brought to the notice of the writer by Mr. E. A. BUTLER who swept it from grass at Royston Heath, Herts (May 28, 1917). The specimens found by Mr. BUTLER, though apparently adult, were not quite fully grown. Subsequently (on June 22), Prof. NEWSTEAD and the writer discovered at Camberley fully mature specimens with ovisacs full of eggs. The parent insects were mostly dead, having been attacked by chalcid parasites which afterwards emerged in considerable numbers. The young coccid larvae began to emerge in considerable numbers on July 15;

11) *Parajairmairia gracilis* Green, observed on July 14, 1914 upon undetermined host plants; in the writer's opinion the insect particularly affects various species of *Carex*;

12) *Eriopeltis festucae* Fonscol., on the upper surface of the leaves of *Festuca*;

13) *Luzulaspis luzulae* Dufour; this occurred not only on *Luzula*, but also on *Carex ovalis* at Camberley;

14) *Ceroplastes rusci* L., examples of this species were sent to the writer on green figs imported from Italy. Though it cannot be regarded as a British coccid, *Ceroplastes rusci* belongs to the same category as *Parlatoria zizyphi* and *Lepidosaphes citricola* which are included in the British list on the strength of their occurrence upon imported fruits in the markets of Britain.

976 - **Coccidae Observed in the Royal Botanic Gardens, Kew, England.** — GREEN, E., ERNEST, in *Royal Botanic Gardens Kew, Bulletin of Miscellaneous Information*, No. 2, pp. 73-76. London, 1917.

In May 1896, when visiting the plant houses at the Royal Botanical Gardens at Kew, the writer observed 16 distinct species of *Coccidae*, and Prof. NEWSTEAD, as the result of a visit the same year, brought up the number to 22. On December 7, 1916 on once more visiting the Gardens, the writer again found 16 species (represented for the most part by few individuals), 3 of which had not previously been recorded from the Gardens (or indeed from the British Isles) and one of the 3 was new to science. The list published by the writer contains:

1) *Lecanium tessellatum* Sign., common on various palms, also on *Tabernaemontana* sp., *Ardisia humilis* and *Ochna pumila*.

2) *L. hemisphaericum*, Targ. on *Carissa* sp. and *Rheedia* sp.

3) *L. longulum*, Dougl., on *Monodora* sp., *Treculia* sp. *Carissa* sp. and *Excoecaria discolor*.

4) *L. oleae*, Bern., on *Erythrina* sp.

5) *L. nigrum* (?) var. *depressum* Targ., abundant on *Musa*, more rarely observed on *Chrysophyllum* sp., *Malacantha* sp. and *Ficus* sp.

6) *L. signiferum* Green, on *Polypodium aureum*. This insect has hitherto been recorded from Ceylon and India only.

7) *Pulvinaria floccifera*, Westw., on *Cordia* sp. A common hot-house pest, attacking orchids chiefly.

8) *Pseudococcus longispinus*, Targ. This appears to be the most widely distributed coccid in the Kew houses. Among its numerous plant hosts were *Musa*, *Cycas*, *Euphorbia* and *Cotyledon Pringlei*.

9) *Ps. citri* Risso : this usually common greenhouse pest was noticed only on *Solandra* and a species of *Euphorbia*.

10) *Ps. nipae* Mask., rather common on various palms ; more particularly on *Cocos*, *Kentiospisis* and *Sabal*. This species had not previously been recorded from the British Isles. Mr. FRYER sent the writer examples of this insect taken on an imported palm, but the insect must have been established at Kew for some considerable time, though hitherto unnoticed.

11) *Diaspis echinocacti* Bouché, on *Cereus* sp.

12) *Hemichionaspis aspidistrae* Sign. on *Polypodium aureum*.

13) *Aspidiotus ficus* Ash., on *Pandanus* sp.

14) *A. hederæ* Vallot, on *Euphorbia* sp. and *Asparagus falcatus*.

15) *Ischnaspis filiformis* Dougl., abundant on various palms.

16) *Lepidosaphes* sp. nov., on *Nephrodium* sp.

After collecting all the data which exist on the subject, it may be said that the species of *Coccidae* hitherto known to be present in the hot houses of the Kew Botanical Gardens are as follows:

1) *Icerya aegyptiaca*; 2) *Orthezia insignis*; 3) *Asterolecanium bambusae*; 4) *Coccus tomentosus*; 5) *Gymnococcus agavium*; 6) *Ripersia filicicola*; 7) *Pseudococcus citri*; 8) *Ps. longispinus*; 9) *Ps. nipae*; 10) *Vinsonia stellifera*; 11) *Pulvinaria floccifera*; 12) *Lecanium hemisphaericum*; 13) *L. nigrum*; 14) *L. nigrum-depressum*; 15) *L. oleae*; 16) *L. hesperidum*; 17) *L. signiferum*; 18) *L. longulum*; 19) *L. tessellatum* (*L. perforatum*); 20) *Pinaspis buxi* (= *P. pandani*); 21) *Hemichionaspis aspidistrae*; 22) *Diaspis boisduvalli*; 23) *D. echinocacti* (= *D. calyptroides*); 24) *D. carueli*; 25) *D. pentagona*; 26) *D. persimilis*; 27) *Howardia biclavis*; 28) *Aspidiotus ficus*; 29) *A. hederæ*; 30) *A. personatus*; 31) *A. spinosus*; 32) *A. dictyospermi*; 33) *A. cyanophylli*; 34) *A. perseae*; 35) *A. aloes* (probably wrongly determined); 36) *Gymnaspis aechmeae*; 37) *Parlatoria pergandi-crotonis*; 38) *Fiorina kewensis*; 39) *Poliaspis cycadis*; 40) *Lepidosaphes pinnaeformis*; 41) *Lepidosaphes* sp. nov.; 42) *Ischnaspis filiformis*.

977 - **Observations on the Coccidae of Europa, Africa and America.** — NEWSTEAD, ROBERT, in *Bulletin of Entomological Research*, Vol. VII, Part 4, pp. 343-380, fig. 1-27, plates VI-VII. London 1917.

#### Systematic description of:

1) *Platysaissetia carpenteri* sp. nov., on the trunk of a fig tree at Ngamba Is. (Uganda);

2) *Pl. ferox* sp. nov., on a shrub with hard wood in the Botanical Garden at Calabar (South Nigeria);

3) *Akermes andersoni* sp. nov., on orange leaves at Kabete (British East Africa); the tree was seriously attacked;



4) *A. quinquepori* sp. nov., on *Microlobium acaciaefolium* in the Botanical Garden of Georgetown (British Guiana); the insect has as a natural enemy a small black ant ;

5) *Lecanium hirsutum* sp. nov., on an indeterminate host plant, in East Africa ;

6) *L. pseudotessellatum* sp. nov., on *Chrysobalanus pellocarpus*, at Aripo, Savana, Trinidad ;

7) *L. wardi*, sp. nov., on the leaves of the Malacca apple (*Eugenia malaccensis* in the Botanical Garden at Georgetown ; numerous individuals of this species were attacked by a fungus ;

8) *L. aequale* sp. nov., on "coupida" (*Avicennia nitida*) on the sea-shore, east coast, British Guiana ;

9) *L. acaciae* sp. nov. on *Acacia melanoxydon* and *Albizia moluccana* at Nairobi (British East Africa) ; the insect is attacked by the larva of a lepidopteron ;

10) *L. adersi* sp. nov., on mango leaves at Zanzibar ;

11) *L. africanum* Newstead, seriously attacking the leaves of the coffee tree at Chagwe (Uganda) ;

12) *L. cajani*, sp. nov., on *Cajanus indicus* in South Nigeria; this coccid is attacked by chalcids ;

13) *L. hesperidum* Linn. on *Phoenix dactylifera* at Bournemouth and Chester (England) ;

14) *L. (Saissetia) hurae* sp. nov., on *Hura crepitans* at Berbice (British Guiana) ;

15) *L. (Saissetia) persimile* sp. nov., on trunks of peach trees, at Nairobi ;

16) *L. (Saissetia) subhemisphaericum* sp. nov., on coffee tree at Naguriga, Chagwe (Uganda) and at Aburi (Gold Coast) ;

17) *Saissetia signatum* on guava tree at Entebbe (Uganda) ;

18) *Saissetia scutatum* sp. nov., on "cannon ball tree" (*Mimusops globosa*) in the Botanical Garden at Georgetown ; the small female colonies of this scale-insect were attacked by a small black ant ;

19) *L. (Saissetia) subpatelliforme* sp. nov., on an undetermined plant at Aburi ;

20) *L. (Saissetia) subhirsutum* sp. nov., on *Blighia sapida* at Odumasi (Gold Coast) ; the individuals of this species were very numerous on the smallest branches ; the coccid is attacked by small red ants ; the same species has also been collected from *Tabernaemontana*, *Landolphia*, *Oroxylon* and *Garcinia* at Aburi ;

21) *L. setigerum* sp. nov., on guava at Nagunga (Uganda) ;

22) *L. (Eucalymnatus) chelonoides* sp. nov., on *Pachira insignis* in the Botanical Garden at Georgetown and on *P. aquatica* on the Essequibo river, near Agatask in British Guiana ;

23) *Aspidiotus camelliae* Sign., on *Erythraspis glauca* at Turkeyn (British Guiana) ;

24) *A. (Chrysomphalus) dictyospermi* Morgan, on rose bush at Entebbe ;



the branches examined were severely attacked by the scale insect ; about 80 per cent. of the colony had been destroyed by a fungus ;

25) *A. (Chrysomphalus) erythraspidis* sp. nov., on *Erythr. glauca* at Turkeyn ;

26) *A. (Evaspidiotus) fimbriatus* Mask. var. *capensis* var. nov., on Cycadaceae at Port Elizabeth (Union of South Africa) ;

27) *A. (Chrysomphalus) mauritianus* sp. nov., on palms in the Botanical Garden at Mauritius ;

28) *A. pimentae* sp. nov., on *Pimenta officinalis* in Jamaica; the damage caused by this species resulted on one estate — Great Valley, in the Parish of Hanover — in the loss of over 2000 trees ; the trunks were covered by the insect which spread in this plantation in the direction of the prevailing winds ; healthy trees are not attacked, but those which are the host of the insect begin slowly to perish, the extremities of the branches showing the first signs of disease ; *A. pimentae* has a natural enemy in the fungus, *Myriangium Duriaei* ;

29) *Chionaspis distorta* sp. ; nov., on an undetermined tree at Windersboom, Transvaal (Union of South Africa) ;

30) *Ch. capensis* sp., nov., on *Acacia* sp. at Pretoria (Union of South Africa) ;

31) *Ch. fici*, sp. nov., on wild fig tree at Kabete.

978 - **Diseases and Pests of Cultivated Plants in the Dutch Indies during 1916.** — VAN HALL, C. J. J., in *Mededeelingen van het Laboratorium voor Plantenziekten*, No. 29. Batavia, 1917.

This publication — compiled by the direction of the Phytopathological Laboratory — summarises the data supplied by the Experiment Stations and by the officials of the Information Bureau of the Department of Agriculture, Industry and Commerce and other information received by the said Laboratory during 1916.

In 1916 crops suffered little from animal pests ; probably the summer monsoon of 1915, which was relatively rainy, had a favourable influence. On the other hand, the greater rainfall favoured diseases due to fungi.

In plantations belonging to Europeans, locusts (*Cyrtacanthacris nigricornis*) did little damage, excepting on a few plantations of Hevea.

*Phytophthora Faberi*, as usual, ravaged various plantations of rubber not only in the rainy season but also in the months October-December of the dry season, which this year was exceptionally rainy. The plantations situated in the low wet parts of the island suffered most from this disease. The heavy rains caused an abnormal fall of leaves of Hevea.

In the west of Java, *Xyleborus coffeae* attacked *Coffea robusta*.

In 1916, *Cryphalus hampei* appeared for the first time in the west of the island, where it occurred on a large scale in plantations of *Coffea liberica* and *C. robusta*.

Rats were troublesome in places to coconut plantations in the residency of Besoeki.

As in 1915, *Helopeltis* attacked many plantations of cacao.

A few tobacco plantations were damaged by storms at Deli ; but in

regard to diseases and pests the year 1916 was a favourable one for the crop.

The heavy rains in the residency of Java caused a partial loss to tobacco plantations through root rot and also through *Phytophthora Nicotianae*.

The chinchona plantations suffered more than usual from "djamoer oepas" (*Corticium* sp.).

Generally speaking, the year 1916 was fairly favourable to tea cultivation (*Thea assamica*, etc.), although *Heliopeltis* and *Cephaleuros virescens* had attacked the plantations badly in places.

Sugarcane suffered from a disease similar to "sereh" which especially damaged the variety 100 P. O. J. Varieties with high sugar yield but with a poorly developed root-system suffered mostly from diseases of the roots.

The mahogany plantations (*Swietenia Mahagoni*) of the forest Service were attacked by a species of *Hypsipyla* which threatens to be fatal to the cultivation of this tree.

The crops of "sono-king" (*Dalbergia latifolia*) were attacked by a disease the nature of which is uncertain.

The following diseases of native crops were brought to the notice of the laboratory. With the exception of a few regions the damage done to rice by insects (*Schoenobius* and *Scirpophaga*) was of small importance. While at Sumatra the rice was attacked by rats, at Java the rice-fields were immune.

A *Cecidomyia* appeared in some Javan residencies, *Leptocorisia* sp. ("walang sangit"), in the residency of Bantam; and at Sumatra some rice-fields were ravaged by *Podops*.

As usual, maize was attacked by the disease "omo lyer" due to *Pearonospora Maydis*.

1916 was an extraordinary year for ground-nuts.

The soy-bean crops suffered in a part of the Paseroean residency from a disease of bacterial origin. *Agromyza* did great injury.

Potato-growing is being extended more and more but is subject to various diseases due to *Alternaria Solani*, *Bacillus Solanacearum*, *Actinomyces Scabies*, etc.

Coconut trees suffered more than usual from *Pestalozzia*, which attacks the leaves. Probably the rains favoured the development of this fungus. In the Ternate residency and on some islands round about, the trees were attacked by *Cyrtacanthacris nigricornis*.

979 - **Fruit Flies (Sub-Genera *Tridacus* and *Dacus*), observed in Erytraea, Nyasaland and Mauritius.** — BEZZI, M., in *Bulletin of Entomological Research*, Vol. VIII, Part I, pp. 63-71, fig. 1-6. London, 1917.

In order to complete his previous paper (1), the writer published the present systematic description of the following species of fruit-flies.

- 1) *Tridacus d'emmerezi*, sp. nov., found in Mauritius in 1916.
- 2) *Dacus annulatus*, Becker; this species was collected in Egypt

(1) See also, B. Nov. 1915, No. 1226.



about a century ago ; it was recorded from Erytraea in 1911, and was re-discovered in Dec. 1916 in Ghinda, Erytraea, where it was very common.

- 3) *D. mochii* sp. nov., also taken near Ghinda in December 1916.
- 4) *D. woodi*, sp. nov., collected in Nyasaland, on September 22, 1916,
- 5) *D. hamatus*, sp. nov., also from Nyasaland (May 11, 1916).
- 6) *D. blepharogaster* sp. nov., taken near Ghinda (November 7, 1916).
- 7) *D. erythraeus* sp. nov., also from Ghinda (December 3, 1916)

980 - ***Crotalaria usaramoensis*, a Plant for Green-Manuring, Resistant to Insect Attacks, in Java.** — see No. 903 of this Review.

RESISTANT  
PLANTS

981 - **The Natural Enemies of the Macrolepidopteron *Oiceticus platensis* (" bicho de canasto ") Attacking Trees in the Argentine** (1). — CARIDE, MASSIMI PEDRO, in *Anales de la Sociedad Rural Argentina*, Year LII, Vol. LI, No. 5, pp. 373-378, figs. 1-8. Buenos Aires, 1917.

MEANS  
OF PREVENTION  
AND CONTROL

In 1916 the author undertook a study of the natural enemies of *Oiceticus platensis* Berg, a pest of trees in the Argentine, and whose ravages have been reported from the province of Buenos-Aires, Pampa-Central, EntreRios, the south of Cordoba and Santa Fé.

Although this insect is very widespread in the south of Córdoba and the province of Buenos-Aires, it is present in such small numbers north of the town of Córdoba and Santa Fé, that it is difficult to verify damage caused by it; this is equally true in Tucuman, Salta and Tujuy. This is due to the fact that, in these districts, *Oic. platensis* is attacked in spring, while it is still in the larval stage, by natural enemies (*Eurytoma caridei* Br. n. sp., *Perissocentrus argentinae* Brad., *P. argentinae* Brad. var. *caridei* Bréthes n. var., *Lindesonium caridei* Br. n. sp.). These enemies are more efficacious than those which attack the insect in winter when it has already reached the chrysalis stage (e. g., *Tetrastichus platensis* Bréthes).

In order to assure the acclimatisation, in the most seriously infested district of the most efficacious of the natural enemies of the insect it is necessary : 1) to collect in December a large number of young *Oiceticus* in the province of Buenos Aires ; 2) to transport them to the north of Córdoba, and distribute them, so that observation is facilitated, on low trees (robinnias by preference), where they will be attacked by their natural enemies ; 3) to collect, a month, or a month and a half after, the same insects, now hosts of their natural enemy, and re-transport them into the district infested with *Oic. platensis*.

982 - ***Euzophera osseatella*, a Microlepidopteron Attacking Potatoes, in Egypt.**

— CASORIA, M., in *Bulletin de l'Union des Agriculteurs d'Egypte*, Year 15, No. 120, pp. 77-81. Cairo, 1917.

INSECTS, ETC.  
INJURIOUS  
TO VARIOUS  
CROPS

At the end of April, 1916, a potato field (" Farineuse rouge " or " Boule de Farine ", " Early rose " and " Kidney " varieties) on a small estate at Zarzamoun (Hehya-Charkieh) was strongly attacked by larvae of mole-crickets, and a coleopteron closely resembling the cockchafer. The soil had received copious supplies of manure, of calcium phosphate and of po-



tassium sulphate. At the time they were attacked the plants had reached about a third of their full growth.

It was necessary to harvest the tubers and to remove the larvae immediately. It was remarkable that a small plot which had been treated with the insecticide "War-worms" and manganese carbonate, was completely free from larvae.

In 1917 it was only possible to plant Cyprus potatoes which, according to the author, are degenerated or hybrid kidneys. The ground was treated with manganese carbonate, to which had been added magnesia, sulphur, ferric oxide, and a small quantity of "War worms".

At the end of April many plants were seen to be drooping; a week later these plants were almost completely dried up, as if they had been cut level with the earth, while many other plants began to fade, either in the same field, or in another about 215 yards distant.

An examination of the soil showed the presence of numerous larvae of a microlepidopteron, identified by the Director of the Entomological Bureau of the Department of Agriculture as *Euzophera osseatella* (fam. *Pyralidae*). This insect, which had been previously reported in Egypt, perforates the stalks of aubergine, and is also found on potatoes.

According to the author the larvae climb about 2 to 3 cm. up the stalk and feed on the pith. A few days later, when the plant attacked begins to fade, the larva leaves it for another, and so on, till it turns into a chrysalis when it weaves its silky cocoon on the stalk itself. As many as four cocoons have been noticed on one stalk. Fifteen or twenty days after the first metamorphosis the insect becomes adult in the form of a tobacco-grey butterfly, 1.5 cm. long.

Besides the drooping and drying-up of the epigeal part of the plant, the insect stops the growth of the tubers, which send out shoots. Tubers thus attacked are useless, both as food and as seed-potatoes, because, if left in the ground, there is no doubt that the ensuing crop will be weak and attacked by the larvae of the insect.

The best method of fighting this pest is to pull up the plants attacked and burn them.

983 - *Tarsonemus pallidus*, a Mite Parasitic on Cyclamen and Other Plants in the United States (1). — MOZNETTE, G. F., in *Journal of Agricultural Research*, Vol. X, No. 8, pp. 373-390, fig. 1-6<sup>1</sup> plates 51-52. Washington, D. C. 1917.

*Tarsonemus pallidus* Banks. (the cyclamen mite), is widely known in the United States, where it causes nearly every year more or less serious damage to cyclamen plants. It also attacks Chrysanthemums and has been reported on the snapdragon (*Antirrhinum* spp.) in Connecticut and Maryland.

The spread of the cyclamen mite is no doubt due to the transport of plants from one place to another.

The writer observed this mite for the first time at the beginning of

(1) See also *R.* June 1917, No. 616.

the autumn of 1916 at Corvallis, Oreg., and has since had the opportunity of examining specimens of *T. pallidus* from different parts of the United States.

After describing the injury caused by the parasite to the leaves and flowers of the cyclamen, the writer gives an account of the different stages of its development, followed by data relating to its life history and the best methods of controlling the pest.

984 - *Physothrips xanthius* sp. nov., a New Thysanopteron Damaging Cultivated Orchids (*Cattleya*) in Trinidad, West Indies. — WILLIAMS, C. B., in *Bulletin of Entomological Research*, Vol. VIII, Part 1, pp. 59-61, 1 fig. London, 1917.

The writer describes, as a species new to science, *Physothrips xanthius* (fam. *Thripidae*), which was found on cultivated *Cattleya* orchids in Port of Spain, Trinidad, during 1915 and 1916.

The larvae and pupae are found with the adults on the upper surfaces of the leaves, particularly near the mid-rib and towards the base of the leaf. They cause severe injury by piercing the surface, resulting in brownish spots or patches on the leaves. In severe cases, the plant may be entirely killed.

Up to the present, this thysanopteron has not been found on wild orchids, and it is possible that it is not indigenous to Trinidad. A large number of orchids are brought over from Venezuela, and the new parasite may have been imported with them.

985 - **Phytopathological Notes on Hevea.** — KEUCHENTUS P. E., in *Mededeelingen van het Besoekisch Proefstation*, No. 24, pp. 49-54. Soerabaja, 1917.

1) **SCOLYTIDAE.** — On a plantation where the tapping-surfaces had been scraped clean, the Hevea trees were affected by Scolytids to such a degree, that latex was flowing from the small holes bored. The bark, however, remained unaffected above the cleaned tapping-surface. It was impossible to take a boring insect for identification. This indicated that it is not desirable to scrape away too thick a cork-layer from the tapping-surface. This not only encourages attacks by borers but also causes the formation of a thick layer of corky bark, making subsequent tapping difficult.

2) **BORING BEETLES.** — The beetle *Dihammus fistulator* Germ, already known as a *Ficus*-borer, also attacks the stem of Hevea, especially on injured spots. Healthy trees are only occasionally attacked. The larvae of the borers should be cut out or killed with benzine.

3) **LATEX-DRINKING BEETLES.** — The beetle *Xylotrupes gideon* L. is sometimes found drinking the latex from the tapping-cut. It, however, has never become a serious pest.

4) **ATMOSPHERIC-ELECTRICITY.** — In addition to ordinary lightning, the so-called St-Elmos-fire also occurs occasionally. Ordinary lightning kills a close group of trees acting as conductors, while the branches of the surrounding trees in the direction of the central conductors get scorched. The results of St-Elmo's-fire are entirely different. In this instance there was no definite close group of damaged Hevea-trees but about ten attacked trees, with some other Heveas amongst them which were entirely unaffected. Three Heveas were dead, but the others had only a burnt topshoot



and normal sidebranches. A similar phenomenon has been described by TUBEUF as "Gipfeldürre", while experiments have proved its possibility.

5) *Cyrtacanthacris nigricornis*. — In consequence of the fact that last year 175 bouws of Hevea on an estate in Besoeke (East-Java) were seriously affected by *Cyrtacanthacris nigricornis* Burm., some observations have been made concerning the development of this insect.

The eggs are laid in the ground in packages. The incubation period is from 5 to 9 months. The newly-born larvae have a size of 7 mm. and pass through six moults. The first moult occurs after 7 to 8 days, the others with intervals of about 12 days. The shortest time between two moults is 7, the longest 16 days. The development period until the last moult is from 2 to 2 1/2 months. One month after the last moult, copulation takes place and then after a fortnight the first eggs are ejected by the female. They may lay eggs 7 times with intervals of about 12 days.

The full-grown insects may live 4 to 4 1/2 months making a total life-time of nearly 7 months from the larval-stage. The total development of this insect takes about 9 1/2 to 13 1/2 months and even longer.

Considering that the insect is continually feeding during this time one can imagine what destruction several million of these insects may bring about.

986 - "*Elm-galerucella*" (*Galeruca luteola*) in Spain in 1917 (1). — DANTÍN CERCEDA, J., in *La Liga Agraria*, Year XXX, No. 1139, p. 2. Madrid, 1917.

*Galeruca luteola* F. Müller, a small chrysomelid beetle known for a long time in Spain, never caused so much damage to the foliage of elms as in 1917. It seems as if the continual drought — there was no rain from the beginning of June — and the sub-tropical heat, especially of the last twenty days of July, were particularly favourable to the growth of the insect.

During the months of May and June, when the larvae had already appeared, the damage was not very marked, but, in July, as the drought and heat increased, the larvae multiplied and became more voracious. The leaves began to fall during the first ten days of August, and, soon after, the trees were completely bare.

Data on the biology of the coleopteron and the methods of control used are given.

987 - *Leucaspis pini*, a Coccid Attacking Pines, in the Argentine. — BRÉTHES, JUAN, in *Anales de la Sociedad Rural Argentina*, Year LII, Vol. LI, No. 5, p. 384, 1 fig. Buenos-Aires, 1917.

In July, 1917, the Biological Institute of the Argentine Rural Society received, from the Province of Buenos-Aires, a pine branch attacked by a scale insect, identified by the author as *Leucaspis pini* (Hartig), commonly known as "pioyo del pino".

This insect, peculiar to the pine, has long been known in Europe,

(1) See also *R. May* 1916, No. 593.

(Ed.)



and, more recently, in North America. This is the second occasion on which it has been found in the Argentine, the first one being in 1906, on material sent from Mendoza.

Up to the present nothing definite is known of the natural enemies of this insect.

Of the different insecticides proposed, those with a petroleum basis seem to give the best results. The following mixture is recommended: petroleum, 1 000 gr. ; soft soap, 400 gr. ; water, 1 500 gr.

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# FIRST PART.

## ORIGINAL ARTICLES

### Forestry in Sweden

by

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**I. AREA AND VALUE OF THE FORESTS.** — Without counting the lakes and water-courses, Sweden has an area of over 101 million acres; about 12 million of these acres are occupied by cultivated land, gardens and buildings, and about 89 million are uncultivated. This last area may be subdivided as follows:

Non-wooded land above the higher limit of coniferous trees, about	17 300 000 acres
Other non-wooded land (peat-bogs, marshes, mountains, heath, burnt forests, land cleared of trees and not replanted), about . . . . .	17 200 000 acres
Wooded land . . . . .	55 041 576 acres
or about 54 % of the total area of Sweden.	

Of all the European countries, Finland alone has a greater proportion of wooded land than Sweden. The proportion for the whole of Europe is 33 %, for western Europe 25 % only. In Sweden there are 965 acres of forest per 100 inhabitants, that is to say, more than in any other country in Europe except Finland; the corresponding figures for the whole of Europe and for western Europe are 183 and 91 acres respectively. At the time of the estimation of the national wealth in 1908, the value of the Swedish forests, including that of the soil was estimated as follows:

State forests . . . . .	230 439 000 crowns <sup>(1)</sup>
Other public forests . . . . .	79 104 000 "
Private forests . . . . .	1 247 651 000 "
<i>Total value . . . . .</i>	<i>1 557 194 000 crowns</i>

(1) 1 gold crown (Krona) = 1s. 1d. at par.



This estimation includes neither the value of the peat-bogs, nor that of the non-wooded land, which are respectively 5 131 795 and 13 800 000 *crowns*, or 18 931 795 *crowns* in all. It is very probable that, during the period 1908-1916, all these values have increased greatly.

II. FOREST REGIONS. — By reason of its great differences in latitude and altitude, Sweden includes many different vegetation zones determined by the various climatic conditions.

The high mountain district, or high mountain heath, completely bare of forest, includes the highest and most northern parts of the kingdom. It runs along the western frontier till it reaches, in the south, a latitude of about 62 degrees.

To the east of this short district, and almost parallel with it, is that of the birch woods, which form a band about 19 miles wide in the north, and rather narrower in the south. To the south it goes a little beyond the preceding region; on the other hand, it encroaches upon some of the heights of the following region. The most common tree is the birch (*Betula odorata* f. *subalpina*), which, together with the aspen (*Populus tremula*) and mountain ash (*Sorbus Aucuparia*), forms sparse, low woods, at present only of indirect importance to forestry — they protect the neighbouring pine forests against the mountain winds.

Below the birch region are the woods of coniferae. These may be divided into northern and southern halves, separated by the northern limit of the oak, which, after crossing Sweden in a NE-SW direction, from the mouth of the river IJungan (Gulf of Bothnia) to Lake Wenner, runs along the lake in a northerly direction, and finally crosses the Norwegian frontier in the north-west of the Province of Wernmland. The greater part of the region of coniferous trees is covered with Scotch fir (*Pinus sylvestris*) and spruce (*Picea excelsa*), either in mixed plantations, often including a few aspen and birch, or else in separate plantations, which also some times include these two deciduous trees.

Although these, as well as other deciduous trees, are gradually attracting more and more attention, the two coniferous trees mentioned are, for Swedish forestry, by far the most important, and form, in the region described, the largest forests in Sweden, occupying the first place in national economy. Systematic forestry, more or less developed, is now practised in the less accessible northern parts of the country, as well as in the southern parts which are better adapted to cultivation. Only in rare cases in the centre and the north of Norrland are there still virgin forests in which hardly a tree has been felled. There the pine usually predominates in dry and poor soils, whereas spruce becomes more and more common as the soil increases in moisture and richness. Most of the plantations have sprung up after forest fires and are often very old; regeneration is mostly on a very small scale. On heaths where there are pines, the trees are usually grouped round stumps and fallen crowns, or under the shelter of trees which are still standing. Growth is slow in the old plantations. Very often the trees cannot utilise the excess of atmospheric precipitation, with the result that marshes are formed. The younger and thicker plantations are stronger and often show good growth.

Deciduous trees, such as the oak (*Quercus pedunculata* and *Q. sessiliflora*), the ash (*Fraxinus excelsior*), the alder (*Alnus glutinosa*), &c., which were formerly very common to the south of the coniferous region, have had to give way more and more to agriculture and artificial plantations of conifers.

The same may be said of the region bordering on that of the beech, which occupies the south and south-west of Sweden. There is, indeed, no distinct boundary between this region and that of the coniferous trees, although the northern boundary of the beech coincides with the original southern boundary of the spruce, which has been artificially introduced into the beech area, often to the detriment of the latter, which was the original principal tree found there.

In this region, besides the beech (*Fagus sylvatica*) and the deciduous trees also found in the coniferous region, there are the elm (*Ulmus montana*) and the hornbeam (*Carpinus*

*betulus*). Where coniferous trees are concerned, the Scotch fir grows wild, whereas the dwarf pine (*Pinus montana*) has been introduced in poor soils of shifting sand, as well as certain other species of the genera *Larix*, *Abies* and *Pseudotsuga* in suitable soils.

Both in the region of the beech and in the south-west of the southern coniferous region there are heaths (*Calluna vulgaris*) entirely, or almost entirely, devoid of trees, occupying about 445 000 acres. Previously these were much larger, but practically all the parts belonging to the State have been planted with trees, as well as a good many of those privately owned, and it is easy to foretell that, before very long, they will all be similarly planted.

III. FOREST ADMINISTRATION. — 1) HISTORICAL. — In the most ancient times all Sweden was one vast forest. Then, as agriculture progressed and rights of proprietorship developed, the peasants, the lords and the church claimed as theirs the forests nearest to the cultivated land. As for the other large forests, they were generally considered as the common property of the inhabitants of the districts or provinces in which they were situated; it was, however, possible for members of a community to obtain certain specified parts of these forests subject to conditions laid down by the most ancient provincial laws of Sweden, drawn up during the 13th. and 14th. centuries. During the 16th. century, the kings seized a large part of the lands belonging to the Church and of the common forests of the provinces, as well as the immense stretch of uncultivated forest land in the heart of Norrland.

In the 19th. century an important economic change occurred. Whereas, previously, State lands were assigned to civil and military officials and to churchmen as official residences yielding a certain income which took the place of payment in kind, these officials were henceforth paid directly by the Treasury, and the State from the middle of that century gradually reclaimed the estates that they might be leased out. The forests adjoining these estates were set apart and included in the State forest land, of which they form the larger part in central and southern Sweden. Of the country estates assigned to them, churchmen have only retained the farm as official residence, the rest being utilised by the State in the manner described.

The kings gave large forest estates to the universities, schools and hospitals, which still possess them, though partly under State control. In order to help their development, large stretches of woodland had also been conceded to the mining and wood industries; those belonging to the mines have mostly passed into the hand of private individuals, the rest have either been taken back by the State or placed under its control; those belonging to the wood industry have either already been reclaimed by the donor, or will be so during the next few years.

In order to encourage colonisation in Norrland, the farmers were granted large stretches of woodland, once they had cleared and cultivated a certain area, and the State kept the rest. Nevertheless, there are still in the "Län" (provinces) of Norrbotten and Westerbotten, immense tracts which are still uncolonised, and where the farmers are still required to clear the land, but under rather different conditions.

During the first half of the 19th. century the State made large grants of forests to private individuals, especially in central and southern Sweden. According to the liberal economic ideas then in vogue, the State and communities were considered incapable of administering lands profitably, and it was decided that the greater part of the State forests should either be given away or sold very cheaply. But, in the middle of the century, before this system had been well developed, there occurred a continual rise in the price of wood, which caused such great forest speculation that fears were entertained for their existence. It then seemed certain that the preservation and continuous yield of the forests were best assured by the system of collective property, and it was decided that the State and communal forests should not be decreased. As a result of this decision, from 1860 onwards, practically no concessions were made, with the exception of those intended to encourage the colonisation of Norrland, the condi-



tions of which, however, were altered; thus, the State reserves to itself the right of control over the forests ceded to farmers during this period, and also over the forests ceded previously in those cases where the conditions laid down for clearing have not been fulfilled. Moreover, in some districts, the farmers have been required to transform a specified fraction of the woodland due to each estate into common forests, which have been put under State control.

The forestry policy thus applied has led to the formation of two large groups of forestry differently administered: *public forests* and *private forests*.

2) PUBLIC FORESTS. — At the end of 1914, these covered an area of 22 150 233 acres, not counting about 12 849 720 acres above the limit of coniferous trees in the districts ("Län") of Norrbotten and Westerbotten which are not yet divided between the State and private holders.

A) STATE FORESTS. — Forests, the income from which goes to the State, or *State forests properly speaking* cover an area of 14 932 140 acres, the rest, 7 218 093 acres, being composed of public forests, the working of which is either undertaken or controlled by the State, but the profits from which go to the communities (towns, "harade" (districts), parishes, etc.), churchmen, private owners, or endowed institutes.

The area of these State forests increases every year: 1) by the addition of certain Lappic land of the "Län" of Westerbotten and Norrbotten, which cannot be ceded to private holders; 2) the reclaiming of forests conceded to saw-mills; 3) by purchase, especially in central and southern Sweden. From 1910 to the end of 1914, there was an increase of 737 996 acres; during the period 1875-1914 the State bought 962 251 acres at a cost of 28 426 786 crowns.

The greater part of the State forests are in the north and centre of Norrland. As the soil of these forests is but slightly productive, they do not yield such a large profit as might be expected judging from their immense area. These profits are also diminished by their distance from means of communication (especially waterways), from the coast and from cultivated districts, which increases the expense of felling and transport. Nevertheless, the expenditure and receipts of the State forests have increased rapidly and continually, as is shown by the figures of 1890 to 1914.

	1890	1900	1914
Gross receipts . . . . .	3 190 426 crowns	8 318 927 crowns	17 256 122 crowns
Expenditure . . . . .	947 883 "	1 855 284 "	6 287 620 "
<i>Net receipts</i> . . . . .	<i>2 242 543 crowns</i>	<i>6 463 643 crowns</i>	<i>10 968 502 crowns</i>

B) PUBLIC FORESTS OTHER THAN STATE ONES. — These may be subdivided into two groups: — a) *Forests conceded for a specific purpose*; b) *Forests belonging to communities*.

a) *Forests conceded for a specific purpose*. — The most important of these are the Church land, which number about 2539 and cover an area of 951 546 acres in all parts of Sweden.

The annual yield of wood is utilised as follows: one part is used for the upkeep and heating of the vicarage; another part is used for the building and upkeep of farms and churches, the rest is sold, and the amount realised, after deduction of expenses incurred, is usually paid in to endowments used for the payment of ecclesiastics.

To this group also belong the forests conceded to: 1) hospitals; 2) churches and other official institutions; 3) certain mines and saw-mills. The area of these forests is 87 528, 91 700 and 140 750 acres respectively. Official institutions and mines have a permanent right to the forests conceded to them, and to the income derived therefrom, but the forests are either



worked or controlled by the State. All the forests conceded to saw-mills will have reverted to the State by 1918.

In this group may also be included the land conceded to the Lapps as pasture for reindeer, in the mountains of the province of Jemtland, and the forests of the Norrland colonists. The reindeer pasture land covers an area of 247 237 360 acres, only 24 868 327 acres of which are wooded. The income derived from it goes to an endowment fund for the encouragement of reindeer breeding. The forests of the colonies (whose origin and aim have been described above) cover 15 068 352 acres and are under State supervision. The entire income derived from them goes to the colonists.

b) *Forests belonging to communities.* — These are forests owned in common by the landowners of a "härad" (district), a parish or a town.

In the parts of Sweden which have been cultivated longest, that is to say, in the provinces round Lake Mälär, and also in Oestergötland and Westergötland, the forests of the "härad" and the towns cover a total area of 244 794 acres. They have to be worked in accordance with regulations laid down by the State Department of Forestry. From the profits yielded by them have to be deducted, in the first place, the cost of administration, replanting, clearing, etc.; the remainder is employed as follows: in the case of towns they are paid into the municipal funds, in the case of the "härad", they are divided among those interested, after the wood required for public buildings has been deducted.

As has been already said, there are, in certain parishes of Norrland and Dalecarlie certain forests belonging to the landowners of the parish but administered and supervised by the State. They cover 1382 830 acres and yield large profits, which go entirely to the parish, thus largely supplying the needs of the landowners, diminishing, or even doing away with the necessity of taxes, besides allowing the formation of substantial funds destined to meet the requirements of each parish.

*The working of the public forests and the State agricultural estates* is directed by a central office — the Royal Estate Office, which controls both forestry and hunting. Since the beginning of the year 1916 this office has working under it, 12 conservators, 118 rangers (forest inspectors), 11 forestry engineers and assistant forestry engineers, 7 directors of forestry schools, all of whom take part in administration and control.

The circuit of each conservator includes from 8 to 11 districts, that of a ranger forms a canton. The duty of the forestry engineers is to apply the laws of forestry throughout the "Län" of Norbotten and of Westerbotten, to the east of Lapland. Besides these chief officials, there are large number of apprentices who help with the administration and management. At the beginning of 1915 these apprentices numbered 220, but many of them were at the same time in the service of private people.

Each canton is divided into many sections, directed and supervised by a forest-guard. At the present time there are 479 such forest-guards besides 27 "tillsyningsmän" (overlookers) and 89 "kronoskogvaktare" (keepers of the Crown forests), who are considered almost as the equals of the forest guards. There is also a large number of keepers and assistant overlookers.

3) **PRIVATE FORESTS.** — These are by far the largest, the most productive and the best situated of the Swedish forests. In the centre and south of the country they belong to more or less large estates. In the forest districts of the north, bordering on the large lakes Mälär, Hjälmär, Wetter and Wenner, and called "Bergslagera" (mining lands), a large part of the forests is in the hands of societies engaged in the mining or timber industries.

In northern Sweden (Norrländ and Dalecarlie) the forests used to belong either to the State or to the peasants. From 1840 onwards, the flourishing timber industry began to buy the property of the peasants, and these purchases increased to such an extent that, in 1907, industrial societies possessed not less than 36.4 % of the land, and even 59.8 % in the Gävleborg district. The social danger of such a development of industrial companies was then understood, and, from that year, they were forbidden to buy land.

These companies often limited themselves to the purchase of the rights of felling, up to a certain minimum for a certain number of years (usually 50), the ground remaining the property of the peasants. This system, however, completely prevented the preservation of the forests, and, as there were continual disputes between the owners of the land and the buyers of the trees, contracts of this kind for a period exceeding five years were forbidden.

The owners of private forests, especially the peasants, have not always managed their forests in the most satisfactory manner; usually the trees have been felled to an extent far exceeding that justified by their annual growth, so that the State has been obliged to intervene in the management of private forests by a series of legislative measures. Thus the laws passed in 1903 have very largely contributed to the better management of private forests by forming in each "Län" (except those of Westerbotten and Norrbotten) a "Commission of Forest Management", with a staff of conservators and "Län" rangers, whose duties are to distribute, free of charge or at a low cost, forest plants and seeds, to give advice on forestry and drainage works, to distribute publications on forestry, etc.

**IV. MANAGEMENT OF THE FORESTS.** — It is obvious that, in a country varying as much as Sweden, forestry must develop very differently according to the interest of the owner of the forest in rational management, the more or less favourable climate of the various districts, the possibility of selling timber at an advantageous price, etc.

**1) HISTORICAL.** — Already in the 18th. century measures were proposed (by Linnaeus amongst others) for the improvement of forest management, and the State began to plant trees in the stretches of moving sands in south Sweden, partly to prevent the damage caused by these sands, but also partly to obtain wood. Before this date the State had tried, by means of various measures and decrees, to encourage the upkeep and replanting of the oak-woods in order to meet the requirements of shipbuilding, and similar attempts were made till the middle of the 19th. century.

It was only after 1860 that all the forests either owned or controlled by the State were subjected to a systematic management based on scientific principles which aimed at obtaining continuously the highest yields. This has been continued ever since, observing, at the same time, the best measures from a point of view of both prudence and preservation. For this reason the amount of wood cut each year has generally been less than the annual growth. At the same time, as in many other countries, the importance of thinning was not recognised till the beginning of the 20th. century. On the other hand, on land which has been cleared, or which has not had woods for a considerable time, forestry has been practised with the greatest care.

The management of many of the private forests of central and southern Sweden was improved almost simultaneously with that of the State forests, often under the direction of foreign foresters, chiefly Danish and German. But, on the whole, it is only during the last 20 years that any real improvement of private forests has occurred.

On the other hand, there are always, in the higher parts of Sweden, districts where the severe climate, the difficulties of utilising the wood economically and the sparse population, make it impossible to cover the expenses which would be entailed by an improved system of management.

As has been said above, the large majority of Swedish forests are composed of pines and spruce; deciduous trees only cover a relatively small area and are of little economic importance,



The following information, therefore, refers essentially to the management of forests of coniferous trees.

2) **AFFORESTATION.** — The methods employed for the afforestation of lands which have been cleared or not planted for a long time, and for the improvement of natural regeneration, are very varied, but they might all be facilitated by the removal of the twigs, branches and crowns of trees left on the ground after clearing.

In order to do this, these remains are collected into heaps a yard high and a yard wide, or else into stacks, and, generally, burnt. Especially on land covered with a high, thick growth which threatens to choke the young plants, the remains are often set alight without being collected. In this case care must be taken to ascertain that, on the one hand, the twigs and branches are dry enough to burn, and, on the other hand, that the ground is not dry enough to suffer loss of humus through burning. For these reasons this operation is usually carried out at night in early spring.

In the snowy Norrland, and on pasture land, the remains from clearing are often left on the ground as they protect the plants from damage caused by snow as well as from the teeth and feet of animals. Some of the twigs are often spread over very dry and poor soils, thus not only decreasing evaporation, but, eventually, by their decomposition, contributing a considerable amount of food-elements.

Where self-sowing is relied on, the ground is prepared by hand or horse hoeing before the seeds fall. If self-sowing cannot be relied on the ground is artificially sown or planted.

Especially in the case of pines reproduction only succeeds with local seed, so that the cones are collected in the district. The Forest Administration, the Commission for the Preservation of Forests, and also private people, have erected establishments for extracting the seed from the cones collected, and many use the most recently perfected methods.

For planting seeds, holes are usually dug  $6 \times 6$  inches to  $12 \times 12$  inches square, and 2 to 3 inches deep, at regular intervals of from 1 to 2 yards; the largest are made where vegetation is thick (heather), the smallest, where it is more sparse (heather and pines). In each hole are placed from 8 to 20 seeds, according to their quality and the favourable or unfavourable conditions at the time of germination and sprouting. Sometimes the holes are made of a long rectangular shape  $2 \times 16$  inches; this affords a better protection against the teeth and feet of animals, and against raising caused by frost.

For pines and spruce it is usually necessary to use from 0.15 to 0.9 lbs. per acre, and the total cost of sowing varies from 8 to 20 *crowns* per acre.

Sowing broadcast and sowing in lines have also been tried, but, as they do not give better results than sowing in holes, and are much more expensive, they have hardly been adopted.

As sowing in holes, when properly carried out, gives very satisfactory plantations and, at the same time, is cheap, it is usually preferred to planting, which is more expensive. Preference is, however, given to planting: on dry ground exposed to the sun and wind, where vegetation is very thick, or where there is danger that the young seedlings may be displaced by frost. On the other hand, planting is also practised to improve insufficient self-sowing or artificial sowing which has done badly, and to propagate spruce in the centre and the south of Sweden.

Nearly all the planting methods common in central Europe and in France have been tested in Sweden, and, as many of them were found suitable, it was unnecessary to experiment on special methods for Sweden. Pines are usually put in the ground when 2 or 3 years old, spruce when 2, 3 or 4 years old; these latter are generally replanted when 2 years old.

The cost of plantation varies very considerably, and depends chiefly on the method employed, the state of the plants, and the number of stones in the ground. Thus, given the most expensive methods, old plants and stony soil, the expenses may amount to 32 to 40 *crowns* per acre.



On the other hand, with less costly methods, young plants and an average soil, the expenses do not exceed 12 to 20 *crowns* per acre.

In order to encourage afforestation the Commission for the Preservation of Forests gives, free of charge, or at a minimum price, large quantities of seed and plants to both large and small forest estates.

Moreover, very considerable afforestation work is being carried out without the collaboration of the commissions mentioned above, especially in the large private forests and the State forests. In the latter, in the year 1914, 4094 acres were planted, mostly after complete clearing.

Especially in the north of Sweden there are large stretches of land where the moisture is too great to allow the trees to grow normally. Here drainage is being carried out, with or without afforestation, and often affects the marshes and peat-bogs. Thousands of acres are thus improved or reclaimed for afforestation every year.

3) UPKEEP OF THE PLANTATIONS. — In intensive forestry the growth of plantations of a certain size is facilitated by removing undesirable self-sown trees, such as birch, alder, aspen, etc., by cutting the excessively luxuriant growth which covers the ground, by clearing the plantations by the removal of plants harmful to their neighbours, and which, at an early date show unsatisfactory progress. Usually, however, the plantations receive no attention till the trees are big enough to be sold, that is to say, for 20 to 40 years in the centre and south of Sweden, and for 50 to 70 years in the north. In the colder parts of Norrland it is usual to wait longer, so long in fact, that no attention gives any economic advantage.

The wood is generally sold in planks or boards. As the value of the trunks, per unit of volume, increases in proportion as they are thicker and less covered with branches, a system of thinning, aiming at producing this result, is adopted. At first the young plantations are thinned very little, rather, they are kept thick, so as to prevent the sunlight from reaching the lower parts of the tree; this causes and hastens the fall of the branches. When the trees are free from branches to a height of about 19 to 32 feet, more rigorous thinning is practised, all dead, sick, forked and twisted trees being removed, as well as those detrimental to the crown of their neighbours. The trees which remain thus have more space, more light and more food, and it is possible for them to increase both their diameter and their crown (this last point is very important, for regeneration for example.) During this operation the trees are distributed as uniformly as possible; in intensive cultivation, 120 to 160 trees per acre to be removed are marked in colour.

In forests where the soil is good thinning is carried out so that the ends of the branches of the trees do not touch; this greatly increases the growth in diameter and strengthens the crown. In poor soils, however, such vigorous thinning does not give the same advantages, as the increase of light does not cause the trees to increase in diameter, moreover, the soil is apt to suffer detrimental modifications as the result of this increase of light.

4) CLEARING AND REGENERATION. — In the centre and the south of Sweden, as well as in the more accessible parts of Norrland, clearing and regeneration are now carried out by means of either complete clear-felling, or felling, leaving seed-bearing trees.

By the first method all the trees on the area to be regenerated are felled. By the second method 20 to 60 stock plants are left per acre. These trees serve both to sow and protect the soil, and are also a protection to the young trees.

The first method is only used if there are suitable seed-bearing trees, or if one kind of wood is to be replaced by another. Thus the spruce, whose superficial root system makes it

liable to be uprooted in storms, and which is consequently unsuitable as a seed-bearing tree, is generally clear-felled especially when it forms pure stands.

On the other hand clear-felling leaving seed-bearing trees is the more usual method in Sweden in pure stands of pines and in mixed forests of pine and spruce. This method has obvious advantages, especially when, as a result of suitable thinning, trees have become sufficiently resistant to storms and have developed large crowns, capable of good fructification. The fact that regeneration is only carried out with really good trees assures transmission of the best qualities.

When clear-felling in Sweden it is of little importance to take into account the direction of the prevailing wind, as is done in central Europe, because there are other means of preventing damage done by wind. In Sweden, the soil being nearly always stony, the roots become very solidly fixed in the ground, and the forests thus become particularly resistant to storms. Of recent years it has been shown that there is a great advantage in felling late, so that the atmospheric precipitation and the poor heat from the sun, may be utilised to the best possible advantage, especially in Norrland.

With the complete clear-felling method, artificial regeneration is practised. With the clear-felling method leaving stock trees, regeneration is carried out, either by self-sowing (the soil often being prepared beforehand), or, if there is a lack of seeds, by artificial sowing.

The methods used in the coniferous forests of France and south-west Germany—selection, gap-cutting, regeneration by groups, strip-felling—have been strongly recommended in Sweden of late years, but are used practically only in small forests, from which a great variety of wood is desired, or which serve as a protection against mountain winds, moving sands, etc., to other forests, fields, villages or towns.

*Unorganised felling.*— This method is used almost exclusively in the less accessible parts of northern Sweden when the consideration in choosing trees for felling is not regeneration but the utility of the trunks for a certain purpose. Even in this case good regeneration is aimed at as far as possible. This extensive selection is called "size-felling", because only those trees are cut which are large enough to be used profitably. Previously this method was very largely practised because it was thought that it allowed the trees which were left standing to reach the maximum growth before felling, and, by their seeds, to form a new plantation in the gaps left by clearing. These results were obtained up to a certain point in some cases, but frequently the trees left did not utilise the free space to increase their growth to any considerable extent, and often they dried up (especially the spruce). Moreover the regeneration which had been hoped for was, more often than not, very slight, and even nil. Many places were invaded by spruce, which established itself firmly in the poor soils, where it only gives an inadequate yield and prevents the growth of pines, which are less exacting and would do better there. The result is that, in numerous forests treated by this method, growth was considerably diminished for many years. As the possibility of selling increases, and new methods of reproduction suited to these districts are tested, these plantations are replaced by younger ones of better growth.

5) PASTURE. — In order to utilise the abundant grass of the valleys, horses, cattle, sheep and goats are turned out to pasture on it, and these animals often wander about without any supervision. These animals, especially the sheep and the goats, do much harm to the plantations by trampling and browsing the plants.

This, combined with the once common practice of removing the young coniferae which gave most shade so as to improve the growth of the grass, has resulted in the fact that, in those forests nearest to farms, coniferae have often been replaced by birch, which requires light. Owing to its rapid growth when young and its capacity of frequently giving off new shoots from the same trunk, the birch stands a good change of surviving the harm done it by animals.

It is particularly in spring when there is little grass, that animals attack trees. For this



reason laws have been passed limiting grazing at this season, but it is impossible to forbid it entirely on account of its real importance for the keeping of cattle by peasants in some parts of Sweden. Thus other measures have had to be taken to protect the plantations, for example: the young stands are fenced in; when clear-felling, branches are left to impede the entrance of animals, or the animal are prevented from entering. The most appropriate measure, nevertheless, would be to reserve the best grass-land for grazing, and to increase its yield as much as possible. This land might be covered with trees in groups or isolated, but wood production must be looked upon as of secondary importance. Only here should the animals be allowed to graze, so that the forests may be kept free of them.

V. *FOREST PRODUCTS.* — 1) *PRODUCTION OF TIMBER.* — It is difficult to estimate the value of the Swedish timber production, for statistics bearing on it are either incomplete or non-existent. Nevertheless, a fairly correct estimate may be formed of the well-kept complete stands. The figures given below may be taken as representing the production of the pine stands during 100 years; they include both the final and intermediate cuttings.

	Best sites cu. feet per acre	Medium sites cu. feet per acre	Inferior sites cu. feet per acre
I. Lapland and Norrbotten. . . . .	6433	4285	2143
II. The rest of northern Sweden (including Dalecarlie) . . . . .	8547	5720	3216
III. South Sweden . . . . .	10720	7109	4285

The complete, well-kept spruce stands probably give, at an equal age, in Districts II and III, a standing stock slightly greater than that of the pines, and, in the "Län" of Norbotten and Westerbotten, about an equal volume.

Another question now arises: — what is the average yield of the forests under the present conditions of preservation? It is, of course, below that already mentioned. Thus, forests composed of pines ( $\frac{3}{10}$  ths.) and spruce ( $\frac{7}{10}$  ths.) on a large estate in central Sweden gave, at the age of 100 years: — on good sites, 7506 cubic feet; on medium sites, 5826 cubic feet; on inferior sites, 3810 cubic feet. An estimate made on 2 952 470 acres of the forests of the "Län" of Wermland (central Sweden) showed the standing stock per acre to be 1077.8 cubic feet, and the annual growth (without bark) to be 31.9 cubic feet.

Repeatedly, for some time past, attempts have been made to calculate the total annual yield of the Swedish forests, taking, as a basis, the estimates of the forests. The results obtained differed greatly, but it may be assumed that, probably, there is an annual yield of 1236 millions of cubic feet.

Attempts have been made to determine whether the annual felling is equal or inferior to the annual growth by comparing the calculated annual yield with the total annual consumption (in the country and exported). Below is an example of the calculation made.

Timber exported in 1911 (unworked timber) . . . . .	340 269 660 cubic feet
Timber converted to charcoal by the mining industry . . . . .	211 896 000 » »
Timber of all kinds used in the country (timber, firewood, including the by-products of felling, etc.) . . . . .	776 952 000 » »
<b>Total annual consumption . . . . .</b>	<b>1 329 017 660 cubic feet</b>
<b>Total annual production . . . . .</b>	<b>1 236 060 000 » »</b>
<b>Annual excess of felling over growth . . . . .</b>	<b>92 957 660 cubic feet</b>

There is, therefore, no need to fear a failure or necessary decrease in the amount of raw material supplied to the timber trade which is of such great commercial importance to



of Sweden. On the one hand, the production of the forests can surely be increased, on the other, it is possible to reduce very considerably the wood requirements of the country. As the means of communication in the north of Sweden increase and improve, greater and greater stretches of woodland may be subjected to rational forestry methods, so that, not only will growth be increased, but it will be possible to utilise trees hitherto unsaleable. The continual rise in the price of wood will necessitate a restriction of its use, which, up to the present, has been excessive. On the other hand, in the manufacture of iron, part of the charcoal used is being gradually replaced by "white-coal" (electricity produced by water-power). These two means of economy will together place a considerable amount of wood at the disposition of the export trade, so that the development of this trade, which has hitherto been so rapid and so advantageous to Sweden, may be assured in the future.

It is very difficult to calculate the total annual production of wood, for no exact data of the requirements of forest owners in fire-wood and timber are available. There is, on the wood sold, a tax calculated in accordance with the value per foot of the standing wood. In 1911, 1912, 1913, this duty was 98, 98.5 and 105.5 *crowns* respectively.

2) SECONDARY PRODUCTS. — Besides wood, the forests give other products, the most important of which are grass and soft fruits.

The grass is generally used as pasture, but there is no basis on which its value may be estimated. The soft fruits, for example, raspberry (*Rubus Idaeus*), blackberry (*Rubus Chamaemorus*), bilberry (*Myrtillus nigra*) and cranberry (*Vaccinium Vitis Idaea*), are used as a food-stuff, cranberries and bilberries being also exported. The value of the cranberries exported in 1909 was 2 130 000 *crowns*, and in 1913, 790 000 *crowns*. The cost of picking, which is fairly high, must be deducted from these totals. Bilberries are exported in smaller quantities.

VI. FOREST LAWS. — The most ancient judicial sources of Sweden, the provincial laws, already contained stipulations concerning the *public forests*, which since then, have been the object of abundant legislation.

The management of the *private forests* has been controlled by forest laws which vary greatly according to district, either as a result of historical factors, or because of the differences in configuration of the country.

This forest legislation, which dates back to very ancient times, has passed through very varying stages of development, between complete liberty and the most minute official control. The new legislation was applied, in the first place, in the six northern "Län" of Sweden. A royal decree of 1866 laid down, for these districts, the following regulation: — "clearing to be carried out from this year onwards or that already carried out which did not satisfy the conditions imposed as to the cession of forests, must be limited as follows: the cutting of wood for sale shall only be carried out according to a scheme drawn up by a competent forestry official, and by order of such an official". This law is in force on a great many estates, especially in the "Län" of Norrbotten and Westerbotten, and in the north of the "Län" of Kopparberg.

On the other hand, most of the estates of the "Län" of Norrbotten and Westerbotten to the east of the frontier of Lapland, already answered to the above conditions before this decree was published, so that it does not concern them. For them a law has been drawn up regulating the size of the trees to be felled, and containing this regulation: "Those coniferous trees (still living) which have not attained a diameter of at least 7.5 ins. (without the bark) at 16 feet above the surface of the ground, shall not be felled without the authorisation of a competent forestry official". This law has resulted in good care being taken of young and medium aged forests.

In the relatively unimportant islands of Åland and Gotland there are also laws forbidding the felling of trees to be sold, except by the authorization of the forest administration.

The year 1903 is memorable in the history of Swedish forest legislation on account of the many laws and statutes, containing new principles, which were drawn up then. Such, for example is the law concerning *protective forests*, which aims at assuring the preservation of the forests required to fix shifting sands or to prevent the degradation of high mountain slopes. Protective forests have been reserved in the high mountains of the "Län" of Jemtland, Westernorrland and Kopparberg. All felling in these districts, other than that for domestic purposes, can only be carried out with the authorization of forest officials.

All the above-mentioned laws and statutes place no limit on the felling of wood for domestic use. The quantity of wood felled for this purpose is, however, relatively unimportant in comparison with the enormous quantity which is cut for sale and which, as has already been said, is generally authorised by the forest officials.

In 1903 also, the *law concerning the other private forests* was passed. This law applies to all the land untouched by the preceding laws and statutes, in other words, the greater part of Sweden. This law decrees that felling and cultural operations must not be carried out in a manner which may prejudice regeneration. Whoever carries out these operations in a manner contrary to the conditions laid down by this law has to find means of assuring regeneration. The application of this law is controlled by the "Commissions of Forest Management" and their agents whose action is regulated by a royal decree of 1903. The Commissions receive annual grants from the State and from most of the "Landsting" (provincial councils), and the income from the tax of 1.3% on the value of the wood sold throughout the kingdom, with the exception of the "Län" of Norrbotten and Westerbotten, and part of that of Kopparberg. The income from this tax, divided by the State amongst the various above-mentioned Commissions, forms the greater part of their funds, which, consequently are largely dependent on the amount of wood cut annually. The income from the 1914 tax, used in 1915, amounted to 982 254 crowns, and, besides this, the Commissions received grants amounting to 248 761 crowns, that is to say, 1 231 015 crowns in all.

VII. FORESTRY RESEARCH AND INSTRUCTION. — 1) STATE FORESTRY RESEARCH STATION. — This Station was founded in 1902. In 1913 it had an income of 62 400 crowns. In 1915 it moved into large premises close to the Experimentalfältet, near Stockholm. This Station, which includes a forestry department and a scientific department, is under the same management as the High School for Forestry. The results of its work are published in the "*Communications of the State Forestry Research Station*", of which, up to 1916, 12 volumes amounting to 2500 pages had appeared. It also publishes pamphlets or short papers on special subjects.

In 1916, a special sub-department was founded to study certain questions bearing on regeneration in the forests of Norrland. The work is to extend over 15 years, and the expenses are estimated at 230 000 crowns.

2) FORESTRY INSTRUCTION. — Up till quite recently the State forestry schools were the *Institute of Forestry*, founded in 1828 to train administrative officials, and the *Schools of Forestry*, where supervisors were trained.

Later, in 1912, it was decided to change the Institute of Forestry into the *High School for Forestry*, which, besides training administrative officials, should also study the development of rational forestry science. It holds: — a) a "Jägmästare" (rangers or conservators) course, preceded by a preparatory course; b) a course for training agents for private forestry (conservators).

In order to be admitted to the "Jägmästare" course it is necessary to hold the certificate given by the secondary technical schools and the efficiency certificate given after the preparatory course. The length of time required for the studies is 9 months for the preparatory course and 2 ½ years for the actual course of the High School of Forestry.

On leaving, the students may enter the State service after doing from 6 months to 1 year of practical work, providing they show sufficient knowledge in all the branches.

In order to be admitted to the course for private forest agents, it is necessary to have a general knowledge corresponding to that required for the leaving certificate of the secondary technical schools, and to have done at least 22 months practical work. The course lasts from 1 to 1½ years.

As has already been said, the High School of Forestry is under the same Management Committee as the State Forest Research Station. The head of the State Estate Office is a permanent member of this Committee.

The *Forestry Schools*, seven in number, are divided among the various districts of Sweden. Each is administered by a director, aided by a forest guard, who also controls the State forests set apart for the instruction of students.

Each school usually has 20 pupils, all of whom receive free instruction and board, and about half of whom also hold studentships of 250 *crowns*.

The courses, which last from the 1st. October to the 15th. September of the following year, aim at giving the students : — a) the scientific knowledge which forms the basis of forestry ; b) skill in the most important forest work ; c) the ability to direct this work.



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SECOND PART.  
ABSTRACTS

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AGRICULTURAL INTELLIGENCE

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GENERAL INFORMATION.

RURAL  
HYGIENE

988 - **Are Anopheles of Non-Marshy Districts Capable of Transmitting Malaria?** — ROUBAUD, E., in *Comptes Rendus des Séances de l'Académie des Sciences*, Vol. 165, No. 12, pp. 401-403. Paris, September 17, 1917.

In spite of the continuous presence of *Anopheles maculipennis* in certain reclaimed districts of France, such as the Dombes, Sologne, etc., which were previously marshy, malaria has not reappeared to any marked extent. This fact has given rise to the supposition that the extinction of the disease may be connected with a sort of natural immunity of the mosquitoes concerned. GRASSI, SCHAUDINN, and other workers admit the existence of species of mosquitoes naturally immune to malarial infection, which appear to have played an important part in the gradual disappearance of the endemic. It has even been suggested that good results might be obtained by the artificial distribution of these species as a malarial prophylactic.

At the Pasteur Institute at Paris patients under treatment for malaria were bitten by perfectly healthy *Anopheles* taken in the town, and it was proved that these mosquitoes were thus infected. The experiments were carried out with: 1) *Plasmodium vivax* Gr. and Fel. or var. *tertiana* Lav. (benign-tertian); 2) *Pl. praecox* Gr. and Fel. or var. *parva* Lav. (malignant-tertian).

The author, who was perfectly healthy, allowed himself to be bitten by one of the infected mosquitoes on the 28th. August. On the 13th. September the fever appeared, preceded a few days previously by exhaustion; the sporozoites (*Plasmodium vivax*) were located in his blood on the 14th. September.

It is seen, therefore, that *Anopheles maculipennis* of the Parisian, non-marshy district, is perfectly capable of transmitting malaria, and is in no wise an immune species. It is, indeed, highly improbable that any such species exists.

- 989 - **Poisoning by *Illicium religiosum* Siebold, in the Philippines.** — GUERRERO, L. E., DE LA PAZ, D. and GUERRERO A. L., in the *Philippine Journal of Science*, Vol. XI, Sect. B, No. 5, pp. 203-213, bibliography of 11 publications. Manila, September 1916.

Experiments, carried out by the authors in collaboration with Miss FELISA NICHOLAS in the Department of Pharmacology of the University of the Philippines, showed that the fruit of *Illicium religiosum* is 14 times more toxic to kittens than *Illicium anisatum*; 0.25 gr. of the former per kilogram of body weight, injected hypodermically, is the minimal fatal dose for cats. The latter is frequently used as a stomachic and carminative stimulant, and in the preparation of various dishes and drinks. Cases are described among the natives and Chinese, where an infusion of *I. religiosum* fruit, taken as a remedy for cholera and other illnesses, caused violent poisoning, characterised by convulsions followed by exhaustion. One case was fatal in spite of medical care.

This matter is of great importance since, as they cost less, *I. religiosum* fruit are often used as a substitute for *I. anisatum*. A table is given of the different characters of the two fruits.

- 990 - **The Degree of Bolting of Flour in Relation to Healthy Alimentation.** — See No. 1067 of this Review.

## CROPS AND CULTIVATION.

- 991 - **Investigations into Soil Efflorescences in Germany.** — PUCHNER, H., in *Kolloid-Zeitschrift*, Vol. XX, Pt. 5, pp. 209-238 + 17 figs. Dresden, May 1917.

A study was made of the formation of saline efflorescences on the surface of natural substances (sand, peat, clay, kaolin, soils) and artificial material (metasilicic acid, calcium carbonate) by atmospheric action as a result of the evaporation of the water they contain.

The results of the experiments, made with sodium chloride, show that the growth of these efflorescences is greatly influenced by the nature of the soil, or other material containing the saline matter. The form and crystalline structure of the efflorescences studied does not only depend on the presence of colloidal humic matter, but also on the fineness of the soil particles. The salt content at which efflorescences start to form is defined as the *coefficient of efflorescence* ("Schwellewert").

The investigation is to be continued in other soils with other salts.

992 - **The Absorption of Cations and Anions by Soil.** — DE DOMINICIS, A., MAMMANO, G. and DIAFERIA I. (Regia Stazione Chimico-Agraria di Portici, 1914), in *Annali della Regia Scuola Superiore di Agricoltura in Portici*, 2nd. Series, Vol. XIII, p. 26. Portici, 1916.

This paper is an experimental contribution to the problem of the absorption of ions by saline solutions. Three principal questions are examined;

1) The actual behaviour of a certain number of ions of saline solutions. In the first place attempts were made to determine whether all the positive ions are absorbed without distinction. For this purpose metals, such as aluminium and iron, of which the absorbant properties of their sesquioxides only were known, were used. It was also sought to determine on which negative ions the absorbing power of the soil was inactive. To this end anions such as the nitrous anions of nitrites, the silicic anion of silicates, and the carbonic anion of carbonates, were examined.

2) The order in which the cations on the one hand, and the anions on the other, follow each other in relation to absorption.

3) The action of the valency of the ions by reason of its great influence on all the phenomena of absorption; it was clear that this must be present in the special case of soil absorption. Moreover, if it be true that coagulation and absorption are related, it is obvious that the valency must influence the absorption as well as the coagulation. Monovalent, bivalent and trivalent ions were tested for this purpose.

The behaviour of the aluminates was also studied in order to determine whether the action of aluminium is similar to that of nitrogen.

All the experiments were carried out under similar conditions so that an exact comparison of the results could be made. Thus, for the proportions of absorbant soil, the conception of gramme-equivalent ion and gramme-ion allowed comparisons to be made with terms of magnitude which were perfectly similar and comparable, thus furnishing determined and rational means of reference. Moreover, these magnitudes, ions and equivalents, must be considered as actual entities which take part in the physico-chemical reactions. The weight of the absorbant, the volume and concentration of the substance to be absorbed, the duration of contact, the temperature, were, therefore, always invariable. On the other hand, in view of the objects of the work, and in accordance with the demands made by it, the nature of the absorbant (soil) and that of the substance to be absorbed (ion of the electrolyte in solution), were varied.

Five different soils were used; chlorides of ammonium, potassium, sodium, calcium, magnesium, aluminium and trivalent iron, were tested for the absorption of the cations. For the absorption of the anions, with the same soils, chloride, nitrate, nitrite, sulphate, carbonate, silicate, mono-acid phosphate and aluminate of sodium were used.

The experiments were carried out as follows:

100 grms. air-dried soil were passed through a 1 mm. sieve, and placed in a litre bottle; 250 cc. of solution corresponding, in the case of deci-molecular solutions, to 25 milli-molecules (1), and in the case of normal solu-

(1) Millimolecules = thousandths of the molecular weight expressed in grammes. (Ed).



tions, to 25 milli-equivalents, were added. The bottle was well corked and put in an agitator. After being shaken for 3 ½ hrs. the bottle was removed and left for ½ hr., after which the liquid was decanted over a dry filter. This liquid was used for the determinations, an aliquot part being used and the results being calculated for the whole. The absorption was determined by the variation in concentration of the solution in contact with the soil.

The results obtained showed that the soil absorbs the cations without exception, not one of them proving inactive. Those most largely absorbed were iron and aluminium, the character of whose sesquioxides were unknown. The anions were also absorbed without exception. It is true that, in some cases, the hydrochloric anion (Cl') and the nitric anion (NO<sub>3</sub>') showed a negative absorption, but there were, among the anions, absorptions which equalled, and even exceeded, those of the cations.

The absorption of the anions may be interpreted without reference to the conception of insoluble chemical combinations to which the absorption of phosphoric acid had hitherto been referred; they are absorbed by amorphous compounds charged with positive electricity in the same manner as the cations are absorbed by amorphous compounds charged with negative electricity.

The valency of the ions absorbed has a special influence on the intensity of absorption. In the case of cations, as in that of anions, the mono-valents are less absorbed than the bivalents, and these less so than the tri-valents. The order in which the cations on the one hand and the anions on the other follow on each other in relation to absorption is identical for all soils; only the general capacity of absorption can vary in different soils. This fact confirms the assumption that, in the absorbant capacity of the soil, the physical character is the decisive factor, and may be explained by the nature of the colloidal substance and of the circulating solution.

993 - **The Humus Content of the Soil as a Guide to Fertility.** — CARR, R. H. (Assistant Professor of Agricultural Chemistry, Purdue University), in *Soil Science*, Vol. III, No. 6, pp. 515-524, fig. 3. Bibliography of 16 publications. New Brunswick, June 1917.

In recent years, there has been a tendency on the part of numerous investigators to question the value of the humus determination in soil fertility work. The writer has been studying the effect of humification of various farm manures, as well as green manures, and has made vegetation tests to aid in estimating availability of plant food contained in the complex plant molecules. He has found that the growing plant cannot directly utilise much of the plant-food contained in other plant products until certain re-arrangements in the molecules have taken place. This is usually brought about by bacterial and weathering agencies cleaving off certain fractions, probably in the order of their availability to the growing plant. The object of the present research was to measure the rate of cleavage by determining the percentage present and the rapidly of increase of humus in the soil as measured by its organic matter soluble in 4 per cent. ammonia by the method devised by GRANDEAU and modified by SMITH.

For this purpose, the writer used a clay surface soil which was very

deficient in organic matter. The soil was screened and mixed with different manures (hen manure, sheep manure, pig manure, horse manure, cow manure and steer manure). Green manures (*Vigna catjang*, lucerne, sweet clover, and oat straw) were also used, being applied either whole or divided. The soil, when screened and mixed, was placed in double boxes holding a cubic foot each; the boxes were buried 8 ft. apart in a trench, the tops being allowed to project a little above the surface of the ground. The amount of organic manure applied at the same time as the lime, carbonate of lime, or dolomite, as the case might be, was equivalent to 1 pound of dry material. The determination of the ammonia-solubility was made at the time the manures were mixed with the soil, and at various subsequent periods. Maize was planted in the boxes containing the green manures (as well as in the other boxes), and the yield was estimated.

The results of the vegetation and humification tests would seem to show that, whenever there is rapid humification of manure, the growth of the plant is greatly stimulated. This is especially noticeable when green manures were rolled under and limed, as compared with disking, or mixing the manures uniformly with the soil. Certain of the manures experimented with, especially steer manure, green lucerne and, to a less extent, cow manure, seem to be as soluble in 4 per cent. ammonia when just mixed with the soil, as after humification. Horse manure appears to humify slowly, and its plant-food was largely unavailable to maize during the first year, but the humification tests show it becomes more available the second year. It was possible to increase the rate of humification of horse manure in the first year by adding dolomitic limestone. Although there is no apparent relationship between the percentage of ash in humus and the growth of maize, the humification and vegetation tests would seem to indicate a rather close relationship between the amount of humus and the growth of maize.

994 - **Ammonia-Fixation in Semi-Arid Soils; Researches in the United States.** --

MACBETH, J. G. (Physiologist, Soil Bacteriology and Plant Nutrition Investigations, Bureau of Plant Industry, U. S. Dept. of Agriculture), in the *Journal of Agricultural Research*, Vol. IX, No. 5, pp. 141-155, 1 diagram, XIV plates. Washington, 1917.

These researches, carried out on various semi-arid soils of California and Maryland, have led to the following conclusions:

1) Many sub-soils of semi-arid land can fix large amounts of ammonia, of which a large part cannot be recovered by the usual methods for estimating ammonia in the soil. Even distillation with an excess of caustic alkali does not result in the recovery of all the ammonia in soils of this type.

2) Prolonged boiling with 10 % hydrochloric acid extracted nearly all the ammoniacal nitrogen in one of the soils under study, whilst less than 75 % was extracted from another soil.

3) The nature of the anion of the ammonium salts used appears to have little or no influence on ammonia-fixation.

4) In semi-arid soils, fixation increases with the depth, to the contrary of what usually happens in damp soils.



5) It increases with the concentration of the solutions of ammonium salts used.

6) It increases with the temperature.

7) It commences very rapidly, then continues slowly for several days.

8) Heating a soil to 200° C or more for 6 hours, decreases its power of ammonia-fixation.

9) The power of ammonia-fixation is also decreased by the addition of salts of aluminium, iron or potassium before the addition of the ammonium salts, while salts of calcium, magnesium and sodium have little effect in this respect.

10) The anions of all these salts appear to be equally without effect in this respect.

11) In semi-arid soils, the quantity of calcium dissolved by ammonium chloride increases with the depth, on the contrary to what happens with chlorides of aluminium, sodium or magnesium. There seems to be a relation between the elimination of calcium and ammonia-fixation, but the evidence is too scanty to allow of any precise deductions to be made.

995 - **Influence of Crop, Season and Water on the Bacterial Activities of the Soil ; Experiments Made in Utah, U. S. A.** (1). — GREAVES, J. R., STEWART, R. and HIRST, C. T. (Department of Bacteriology and Chemistry, Utah Experiment Station), in *Journal of Agricultural Research*, Vol. IX, No. 9, pp. 293-341. Bibliography of 66 publications. Washington, D. C., 1917.

It is of the utmost importance that the quality and quantity of plant food rendered available during the season should nicely balance that required by the growing plant, for then we have the maximum yield with the minimum loss of soil fertility. Most of the changes which take place in the soil constituents are caused by micro-organisms ; the speed with which these transformations take place within a soil is governed, amongst other factors, by the season of the year, the crop, and the water which the soil receives.

The writer carefully examines the literature dealing with the subject, and sets forth the results of his experiments carried out on soil of a sedimentary nature. There were 5 series of 4 plots ; one series was fallow, while the others were under lucerne, maize, potatoes and oats respectively. In each of the 5 series, one plot was not irrigated, while the others received a minimum (15 inches), average (25 inches), and maximum (37.5 inches) amount of water, which was applied 5 times in equal quantities. The plots were sampled during the spring (about the middle of April), mid summer (about the end of July), and in the autumn (about October 31 or November 1). The samples were analysed for moisture, nitric nitrogen, number of bacteria developing on synthetic media, and the ammonifying and nitrifying powers.

It was found that during spring and summer the nitric nitrogen is about uniformly distributed throughout the first 6 ft ; in soil under lucerne the amount remains relatively small during the different seasons, but is a



little larger in autumn than in spring. In this layer the *absolute* amount of nitrates formed increases with the quantity of water supplied. On the other hand, the *relative* quantity of nitrates, that is to say, the amount bearing a relationship to the water supplied, is greatest where only 15 inches of water are given. In the upper layer of the fallow plot and of those under potatoes, oats, and maize respectively, the relationship of nitrate formation to water-supply is exactly the same as in the case of the lucerne plots.

Large quantities of nitric nitrogen disappeared from the fallow soil during the summer months. This is attributed to the growth of bacteria which transform it into protein substances, and not to denitrification.

The larger applications of water carry much of the nitric nitrogen beyond the sphere of action of the plant, and this accounts for the decrease in crop yield, which is often noted when excessive quantities of irrigation water are applied to the soil.

The application of water to a soil depresses the number of organisms which will develop on synthetic agar in lucerne, oats and potato soil, but increases them in fallow. The results obtained with maize are irregular. The ammonifying power of all the soils, except the lucerne, was increased by irrigation. Water increased the nitrifying powers of all the soils, except the oat soil. There was a difference of 2° F. in the temperature of the irrigated and non-irrigated soils. This difference in temperature was perceptible to a depth of 4 ft.

The number of organisms is higher in the cropped than in the fallow plots, and this is probably due to the plant residues left upon the cropped soil.

Naming the soils in order of increasing ammonifying power, we have: lucerne, oats, maize, potato and fallow. By naming them in the order of increasing nitrifying power, they are: fallow, maize, oats, lucerne and potato. The lucerne not only feeds closer upon the nitric nitrogen of the soil than do other crops, but it also increases the nitrifying power of the soil. Hence it would deplete the soil of its nitrogen more rapidly where the entire crop is removed than would other crops.

The use of irrigation water, by increasing the bacterial activities of the soil, renders the nitrogen soluble, and where excessive quantities of water are used, much of the nitrogen is washed from the soil, thus unnecessarily depleting the soil of its nitrogen. This in turn gives diminished crop-yields.

#### 996 - Methods for Determining the Reaction of the Soil; Investigations in Denmark.

— CHRISTENSEN H. R., in *Tidskrift for Planteavl*, Vol. 23, pp. 1-83. Bibliography of 33 publications. Copenhagen, 1916.

In previous papers (1) the Author described the results of investigations undertaken to determine the influence of the state of the soil on its reaction and basic quality, and showed this influence to be very complex. He also showed that the determination of the reaction of the soil may form a criterion of its lime requirement. Although the methods used were mainly

(1) See R. 1916, No. 843.

*qualitative*, they permitted a fairly just estimation to be made because, contrary to the requirement of nitrogen, phosphorus and potassium, the lime requirement is not shown by the amount of assimilable nutritive elements in the soil, but represents, rather, a peculiar state of the soil characterised by the presence or absence of certain substances of a basic nature.

Exact *quantitative* methods of determination would, in many cases, give very interesting results, but, for the moment, the Author limits himself to a study of the *qualitative* methods in use up to the present (the testing of acidity with litmus or *Azotobacter* cultures), which show whether the soil does or does not contain the necessary basis substances, although they give but a vague idea of the eventual requirement and reserves of these substances. The practical value of the quantitative determination of the acid or basic quality of a soil in relation to its lime requirement must not be exaggerated, because the liming and marling of soils very poor in lime gives them a sufficient quantity of this base to last for a certain number of years, and, besides, the more-complicated and costly the experimental methods are, the less easy is their practical application. On the other hand, results obtained by quantitative methods would doubtless lead to a greater knowledge of the complicated relationships between soil and lime, and might be of great importance in the scientific study of the influence of lime, in various quantities, on the condition and fertility of different soils. Nevertheless, *qualitative* determination is of great importance in the scientific study of the influence of the acidity or alkalinity of the soil on its physical, chemical and biological conditions.

In 1915 the Author studied the *quantitative* determination of the acidity of the soil, and in a second series of investigations compared various methods for the *qualitative* determination of the reaction of the soil in connection with quantitative determinations of the soil's capacity for setting free the acids of various salts.

The results of these investigations show that it is difficult to distinguish the *effective acidity of the soil* from its *capacity for setting acids free*, or absorbing (neutralising) basic substances. Most of the methods proposed for the quantitative determination of the acidity of the soil in no wise show its true content in acid-reacting substances (i. e. substances which, in solution, give a hydrogen-ion concentration greater than  $10^{-7}$ ), but only its capacity to absorb (neutralise) basic substances, which is due, partly to the presence of acid-reacting substances, partly to the presence of colloids unsaturated with bases, or other substances which, through they have no acid reaction, absorb bases. There is no method which allows a reliable *quantitative* determination of *actual acidity*, although that proposed by HOPKINS and his collaborators, and that of DAIKUHA with chloride solutions (1) seem, in many cases, to throw valuable light on this subject.

To determine the soil's capacity to absorb bases, BAUMANN and

(1) See B. 1914, No. 980.

(Ed.)



GULLY's acetate method is preferable to that of TACKE and SUCHTING, not only because it gives more reliable results, very near to the absolute values, but also because it is more rapid.

BAUMANN and GULLY's assertion that there are no free acids in peat-moss is probably incorrect, for the Author's investigations show that the capacity to absorb bases, which is characteristic of this type of soil and of others which give an acid reaction to litmus, is always due to the presence of substances with an effective acid reaction. This agrees fairly well with the theory, laid down by the Author in a previous paper, that crude, unsubmerged peat contains a large proportion of these substances. No more exact is the assertion of BAUMANN and GULLY, supported by RAMANN, that the capacity of a soil to turn neutral litmus solution red does not prove the presence of free acids in the soil, but is only due to the capacity of the soil colloids to liberate the acids of neutral salts. It has been proved that no close relationship exists between a soil's capacity to liberate acids (determined by the calcium acetate method) and its litmus reaction, for many soils which, when tested by this method, show a high capacity for liberating acids, give a neutral, or even slightly alkaline, reaction to litmus. On the other hand, the fact that only soils capable of setting free acid from potassium chloride solutions give a distinct acid reaction to litmus, proves that the capacity of a soil to turn neutral litmus solution red is due to the fact that it contains substances with an effective acid reaction. Hence the importance of the litmus test in soil investigations, especially when it is necessary to know the requirements of the soil in basic substances.

The determination of the soil's power to absorb bases is not sufficient for an estimation of the soils' lime requirement, for it has been found that many soils which, by the preceding investigations, were shown to be deficient in lime (e. g. by the absence of development of *Azotobacter*), are less capable of liberating the acid of a calcium acetate solution than other soils which do not show a deficiency of lime (by the *Azotobacter* test).

The determination of the acidity of the soil gives no certain indication of its lime requirement. As has already been shown, all mineral soils giving an acid reaction to litmus have a great need of lime, and, in such cases, the determination of the acidity of the soil not only shows the amount of lime required to neutralise the acid present, but also gives an estimation, worthy of consideration although inadequate, of the soil's lime requirement. Nevertheless it must not be forgotten that many soils giving a neutral reaction also have a very real need of lime, and, in these cases, the determination of the acidity will give no indication of this need.

Stress should be laid on the fact that the qualitative determination of the lime requirement by the combined litmus and *Azotobacter* test, in general use in Denmark, does allow this requirement to be estimated up to a certain point. There is no doubt that soils giving an acid reaction usually require a larger quantity of lime than neutral soils in which *Azotobacter* is absent. A large number of experiments with field tests are still required to clear up the important question of lime treatment.

As the Author stated previously, it is probable that the question of



the lime requirement of soil is primarily one of the presence or absence of certain compounds of calcium or magnesium which saturate the acids and are easily decomposed. If this be so, experiments aiming at expressing quantitatively the soil's lime requirement, should seek methods which will show the amount of lime necessary to supply the soil with a sufficient quantity of these compounds. At present it is still impossible to know whether such methods can be devised, and whether they should be based on chemical or biological criteria.

997 - **The Quantitative Estimation of Calcium Carbonate in Determining the Nature of Soils.**—PASSERINI, N., in *Bullettino della Società Botanica Italiana*, Nos. 4-5, pp. 50-52. Florence, April-May, 1917.

When soil is called granitic, serpentinous, or trachytic, reference is made, not to its composition, but to its origin. On the contrary, when speaking of calcareous soil, it is usually meant that it is also rich in calcium carbonate. Because a soil is derived from limestone it does not, however, mean it is rich in calcium carbonate, for there are compact limestones which contain relatively little. The various factors causing loss of calcium carbonate must also be taken into consideration. The necessity for a quantitative estimation of calcium carbonate, even though it be but approximative, is thus clear.

This necessity is further proved by the results of 21 determinations of calcium carbonate (I) made in different soil samples from the same compact limestone ("Alberese"). The amount of calcium contained in them varied between 0.1 % (traces) and 55.90 %, thus showing that the composition differed greatly in the soils tested, although they were all taken within a small area. By their origin all these soils were calcareous, but, if this term is to include their richness in calcium carbonate, it should only be applied to four of them which contained from 23.65 to 55.90 % of calcium carbonate. It is, therefore, not impossible that a quantitative estimation of calcium carbonate would modify the classification of plants as *calcicolous* and *calcifugous*, a classification which frequently is only based on a qualitative examination of the rock.

998 - **Cultural Experiments in Mangrove Plantations in Madagascar.**—TOLLIM, N., in *Revue agricole et vétérinaire de Madagascar et Dépendances*, No. 9, pp. 36-40 + 1 pl. Tananarivé, July, 1917.

OPENING-UP  
LAND FOR  
CULTIVATION

On the Madagascar coast there are large stretches covered with mangroves. As the cultivation of mangroves has been carried out in too intensive a manner, and as the plants grow very slowly, it has been suggested that the plantations might be converted into cultivable land. These soils, which are under water at high tide, are usually composed of a thick mass of more or less decomposed vegetable matter, mixed, according to the deposits of the sea or neighbouring rivers, with sand or mud, or even with alluvium. They are often very rich and form a valuable capital.

(1) Carried out with the Author's calcimeter.

(Ed.)

An interesting cultural experiment in mangrove plantations was undertaken on the west coast of Madagascar. The land chosen is submerged at high tide only.

The experiments were started in 1913 on small plots of about  $7\frac{1}{2}$  acres which were dammed and planted with coconut trees. The results were so satisfactory that a further experiment on a larger scale was attempted. The work was started in 1914, interrupted by the war, continued in 1915, and finished only in 1917.

The land chosen had an area of about 198 acres; it is from 1.64 to 4.83 feet below the level of high tide, that is to say, about 8.20 feet above the low waters of the spring tides and only 3.28 to 4.82 feet above the low waters of the neap tides.

The soil is silicious sand mixed in places with clay, all amalgamated, to a depth of many feet, by an accumulation of badly decomposed vegetable detritus composed of mangrove roots and leaves. The whole forms a very rich, permeable soil, but saturated with water and a large number of injurious substances.

The land was first isolated from the sea by temporary dykes and the work then begun. The permanent dykes vary in size according to the level of the land. Viewed in section they form a regular trapezium, whose small base (summit) is 8.20 feet wide, and whose sides have an incline of  $45^{\circ}$ . The summit is 3.28 feet above the highest tides. The total height is from about 11 to 13 feet. The whole structure is of well-beaten earth covered with dog's tooth grass (1), which is resistant to salt water.

These dykes are cut by three stone-works, each of which has two automatic wooden valves which close the openings of cement conduits with an internal diameter of 1.30 feet. The stone-work and conduits form a very strong mass, supported by piles well driven in.

Drainage is by 14 344 feet of canals, 5 feet wide by 4 feet deep, placed 33 feet apart, and by three collectors, 10 feet wide and 5 feet deep, which empty their water into three reservoirs, which lead it into the neighbouring "arroyos". Soil drainage is thus assured to a depth of about 3.28 feet.

The ground was planted with 11 000 coconut trees, and several acres were also planted with rice. The cost amounted to about £ 9 per acre planted with 59 trees. The success of this experiment is almost assured.

It is necessary to prepare the mangrove plantations two years before cultivating it, in order that it may be sufficiently freed from salt and the large quantities of tannin contained in the vegetable detritus.

As rice is fairly resistant to salt and as the ground is really salt on the surface during the dry season only, the cost of reclaiming the land for rice growing should not exceed £ 1 to £ 3 per acre.

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(1) See also R., June, 1917, No. 525.



999 - The Construction of Reservoir Dams in France. — LEVY-SALVADOR, PAUL, in *La Nature*, No. 2295, pp. 177-182, 8 figs. Paris, September 22, 1917.

PERMANENT  
IMPROVEMENT:  
DRAINAGE  
AND  
IRRIGATION

In the central massif range of France there is a fair number of stone reservoir-dams, all built of hydraulic lime mortar. The perfect state of preservation of some of them after fifty years shows what excellent results may be obtained by this method of construction. Although many of the dams recently built in France and abroad, especially in the United States, are made of other material, such as steel, reinforced concrete, or cement, stonework still seems to offer the greatest guarantee of safety for works the rupture of which would entail disastrous consequences. It is only this question which the author studies, explaining the principles to be observed in making a reservoir-dam. As an example the Cher dam is taken. This dam, about 9 miles from Montluçon, is 154 feet high and holds 1060 million cubic feet of water with only 529 640 cubic feet of stone work.

The site of the dam must answer a certain number of requirements rarely found together. The transverse section of the gorge to be dammed must be as narrow as possible, so as to reduce the stonework required. Up stream the bed must open out so as to form a large basin, otherwise the cost per cubic foot stored will be excessive. Care must be taken not to flood valuable land, houses, or roads, as derivation entails considerable expense. The durability of the work depends as much on the nature of the soil and the bed as on the walls. The soil must be resistant both to compression and undermining, with neither faults nor clay pockets, which, in time, would ruin the wall. A geological study by means of borings is indispensable.

The geological study made for the Cher dam gave most satisfactory results; the bed was of very hard grey granite, there was no fear of faults, and the perpendicular fissures could easily be stopped up. Care must be taken to ascertain that, in the area to be flooded above the dam, there are no leaks through which the stored water may escape. Once the desired site is found the work may be proceeded with. The density of the stone on the site is determined by direct weighing, and it is tested for its degree of porosity, its permeability, its resistance to compression, strain, etc. The density of the stonework may be established by a very simple calculation. The stone of the Cher dam weighed 2670 kg. per cubic metre. The mortar, containing 350 kg. of hydraulic lime per cubic metre, weighed 1900 kg. per cubic metre. The usual proportion of mortar in stonework is 40 % of the volume; this was deducted for the density of the stonework:

$$(2.67 \times 0.6) + (1.9 \times 0.4) = 2.36.$$

Calculations are then made of the necessary measurements of the transverse section of the wall at its highest point. The form most generally used for the transverse section of the wall is that of an isosceles rectangular triangle, whose vertical side represents the up-stream wall. In practice this wall has a slight batter (0.10 to 0.20 per metre). The size of the coping of the wall depends on local conditions (4 to 10 metres). The construction rests on a very thick stone base, firmly built into the ground at the foundation.



The conditions of resistance which the construction must fulfill are laid down in a circular of the French Department of Agriculture under date June 15th., 1897. The essential conditions are :

- 1) The impossibility of slipping in a horizontal direction, that is to say, the weight of the stone work must be greater than the water pressure ;
- 2) The limitation of the maximum compression stress in one point of the down-stream wall. In practice the compression stress may without danger reach  $\frac{1}{10}$  of the breaking stress. The compression stress of stonework may conveniently be limited to 12 kg. per square centimeter in dam walls not exceeding a height of 30 metres, but, for constructions reaching a height of 70 and 100 meters, at least 15 kg. per square centimeter may be allowed if the soil at the foundations is very resistant and the materials of good quality.
- 3) The stones of the up-stream wall to be subjected at the joins to a minimum compression at least equal to the pressure of the under-current. This condition, which is necessary to prevent cracks in the construction, is sometimes fulfilled by increasing the thickness of the construction.

The stonework of the up-stream wall should be as watertight as possible. For this purpose the Cher dam was first covered with a 3 cm. thick coating of Portland cement mortar containing 600 kg. of cement per cubic metre of sand. Over this was laid a thick layer of coal-tar, covered with milk of lime to prevent too great an absorption of heat by the black colour when the reservoir is empty. These measures seemed sufficient for a 47 metre wall. The down-stream wall was simply pointed.

The dams are based on the arc of a circle with a radius of 150 to 200 metres, the convexity being turned up-stream. This arrangement has two advantages: 1) to build the construction let in two sides of a gorge, like an arch, thus gaining increased resistance; 3) to close any possible opening of vertical fissures produced by the expansion and contraction of the masonry under the influence of the heat of the sun.

Though the construction is influenced to a certain degree by local conditions, it varies very little on the whole.

A description of the building of the Cher dam, begun in July 1906, and finished during 1909, is given and may serve as an example for the construction of stone dams.

1000 - **Blasting Ditches.** — MURDOCK, H. F., in *Montana Agricultural College Experiment Station, Circular No. 55*, pp. 6, figs. 7. Bozeman, Montana, February, 1916.

The circular describes the blasting of drainage ditches on the Bozeman Experiment Station farm between the years 1913 and 1915, and gives practical details of the work.

It is particularly in gravelly and rocky soil that ditching is difficult and that blasting may be carried out to advantage.

Preparatory to starting the work all the brushwood is cleared off. Holes are then dug 22 inches apart. Experience showed this distance to be the most satisfactory; if it be less there is unnecessary waste of explosive, if more some of the charges misfire. Two sticks of 60 % Hercules dynamite are placed in each hole, which are dug by steel bars  $2\frac{1}{2}$  feet long,

driven in the earth to within 4 or 6 inches of the surface, and withdrawn either by hand or machine.

To prevent the holes from caving in, tubes made of 1 inch galvanised iron pipe are inserted and the charge passed in through them. The pipes are then withdrawn. As the holes fill with water no further tamping is necessary. About 25 holes are exploded at once, the middle hole being used as the primer and joined to the others by a waterproof fuse. An electric detonator may be used.

Three men are necessary for the crew. The channel made by the explosion is 2 to 3 feet deep and 5 to 7 feet wide. After blasting, the channel is cleared out by hand. As dyanamite freezès very easily, the work must be done at a suitable season.

The following comparative expenses of making open ditches were drawn up from the Station accounts :

Hand dug ditch . . . . .		\$ 3.35 per rod
Blasted ditch	hand labour, inexperienced . . . . .	\$ 3.10 " "
	hand labour, experienced . . . . .	\$ 2.36 " "

Blasting ditches by dynamite has proved both practical and economical under the conditions existing at the Station. No piles of dirt are left along the bank, thus ensuring a good flow of surface water. The figures illustrating the circular show that the ditches may be made very regular, and allow the comparison of work carried out by a ditching machine and that carried out by dynamite.

1001 — Drainage-Ditches excavated by means of Internal-Combustion Engines. — See No. 1053 of this Review.

1002 — Experiments in Irrigated Crops in the United States. — I. KNORR, F., Management of Irrigated Land, in *Bulletin of the Agricultural Experiment Station of Nebraska*, Vol. XXVII, Art. IX, *Bulletin* No. 152, 24 pp. 12 tables. Lincoln, Nebraska, June 1915. — II. HARRIS, F. S., The Irrigation of Potatoes, in *Utah Agricultural Experiment Station, Bulletin* No. 157, 20 pp., 8 fig. + 1 plate. Logan, Utah, June 1917.

I. — Experiments carried out for 3 years at the Scottbluff Experimental Farm, Nebraska, by the University of Nebraska in cooperation with the U. S. Department of Agriculture, on about 30 acres of land capable of irrigation, in order to determine the value of autumn irrigation in increasing spring crops.

In the region under consideration, the rainfall is very small and it is therefore necessary to irrigate the land in the spring before sowing. The object of autumn irrigation is to store up water in the soil for the use of the spring crops. One advantage of autumn irrigation is that the soil has an opportunity to freeze and thaw during the winter, thus aiding to produce a better tilth in the spring. If the water is evenly distributed, autumn irrigation is very beneficial.

Compared with the plots which were not irrigated in autumn, the plots



irrigated at this season gave excellent results ; the average crops during a period of 3 years being as follows :

*Wheat* : 5.5 bushels per acre.

*Barley* : 7 bushels per acre.

*Oats* : 11 bushels per acre.

The averages for a 2 years' period were :

*Maize* : 10.6 bushels per acre.

*Sugar-beets* : 1.6 tons per acre.

*Potatoes* : 2.3 bushels per acre.

The land for the experiment plots was broken out of the virgin sod during the autumn of 1910 and irrigated after ploughing. It was necessary to work down the land previous to irrigation. In 1911, and in succeeding years, the land, being light, was irrigated in the autumn and ploughed as soon as it was dry enough. It was found that land irrigated in autumn did not require as early irrigation in the summer and thereby saved considerable labour at this time of the year. The cereals received 2 irrigations, the maize 1, and the beets and potatoes 3.

*Potatoes.* — In 1912, an experiment was begun to determine the best method of irrigating potatoes, taking also into account the methods of cultivation, labour, and water requirements:

So far, this experiment has only furnished useful data concerning irrigation.

The usual practice has been deep cultivation and ditching ; the cultivation is often from 5 to 8 inches deep, and when the potatoes are properly ditched, the ridges are over 1 foot high. In common practice, every row is irrigated throughout the season after irrigation once becomes necessary.

The 5 methods of applying water in the experiment have been :

1) To irrigate every row, keeping the soil moist, and the plants in a growing condition. Yield : 296 bushels per acre.

2) Not to irrigate until the plants require water, then to irrigate every row and irrigate according to common farm practice : Yield : 270 bushels per acre.

3) Irrigate every row, but permitting the plants to suffer between irrigations. Yield : 234 bushels per acre.

4) To irrigate alternate rows at such times as the crop requires moisture ; at the second irrigation the skipped rows are irrigated and the previously irrigated rows omitted. Yield : 239 bushels per acre.

5) To irrigate every other row throughout the season. Yield : 215 bushels per acre.

Under the usual method, it required approximately 2 hours and 30 minutes to run through rows 264 ft. long. Where water was run in alternate rows, it required 5 hours running, and then the soil was not in as good condition as when every row was irrigated.

II. — The experiments in the irrigation of potatoes at the Greenville



Experiment Farm, Utah, lasted for 5 years. The soil is a well drained uniform clay loam to a great depth.

The Bulletin analysed passes in review most of the literature dealing with the subject. The results of the experiment are summarised as follows :

The highest yield of potatoes was produced where small, irregular irrigations were given.

One inch weekly, or a total of 12.8 inches during the season, gave a higher yield than any other treatment.

When as much as 96 inches of water were applied, the yield was less than where no water was given. Watering the land after planting the potatoes and before the plants were up, reduced the yield below that where no irrigation was given.

Where but one irrigation was applied, it gave best results if applied when the potatoes were in full flower. The second best stage was just as tubers began to form.

Discontinuing irrigation during the rapid growing season, after it had once begun, decreased the yield.

Excessive moisture, or that applied late in the life of the plant, increased the relative production of vines. The relative number of tubers per hill was increased by early irrigation, while the relative size of the tubers was influenced more by late water.

Height of vines was affected much less by the treatment than yield of tubers.

The experiment brings out the importance of an even supply of soil moisture during the middle portion of the life of the potato after the tubers begin to form, and before they begin to ripen.

1003 - **Lime on the Farm in New South Wales, Australia.** — GUTHRIE, F. B., in *Department of Agriculture, New South Wales, Farmers' Bulletin* No. 115, pp. 31. Sydney, July 1917.

MANURES  
AND MANURING

Instructions of a monographic character upon the different uses of lime in practical agriculture.

After having set forth the advantages of liming, and the lime content of the South Wales soils, the writer considers the different forms in which lime is applied — carbonate of lime — agricultural, or mild lime (containing about 82 per cent. of lime); this is the name given locally to the stone-lime that has not been properly burnt — gas lime — residual lime from acetylene generators — spent lime from tanneries — wood ashes and plant ashes — gypsum — basic slag.

The residual lime from acetylene generators contains from 36.19 to 64.38 per cent. of lime. It can be used in a fresh state, while gaslime must be exposed to the air for some time before being applied.

A sample of spent-lime from tanneries contained in addition to an appreciable amount of nitrogen and traces of phosphates and potash, 49.5 % of calcium hydrate and 26.0 % of calcium carbonate.

Among the Australian ashes analysed, the case of the ash of *Gidgea acacia* (?) is exceptional. This contains 95 per cent. of pure calcium carbonate. Gypsum is of great value in neutralising the carbonate of sodium which ren-

ders soil, or water, alkaline and caustic. The writer mentions an experiment in which the alkalinity of a water estimated at 35.28 grains of sodium carbonate per gallon was reduced to one half after 24 hours, and to 10.92 gr. in 6 days, after which the decrease was very gradual.

The writer gives the amount of lime to be used for liming and sets forth the bad effects of lack of lime in the soil, and of its excessive use or misuse. He then deals with the other uses of lime on the farm: in the formation of the compost heap — as a fungicide or insecticide, whether alone, or mixed with other compounds, or in the form of gypsum — for softening water whose hardness is due to the presence of calcium carbonate — for making white-wash — for waterproofing corn-sacks — for making artificial stone.

The writer concludes by expressing his hope that the present transport concessions for agricultural lime will be extended to all forms of lime used for agricultural purposes in Australia.

**1004 - The Composition of Army Stable Manure.** — RUSSELL, E. J. (Rothamsted Experimental Station), in *The Journal of the Board of Agriculture*, Vol. XXIII, No. 11, pp. 1053-1055. London, 1917.

In many parts of the country, Army stable manure in being produced in considerable quantity. Several samples of this manure have been analysed at the Rothamsted Experimental Station. The results obtained are summarised in the following tables, which also show how this manure compares with ordinary manures.

*Percentage Content of Army Stable Manure in Comparison with Farmyard Manures.*

Composition	Army stable manure				Farmyard manure Rothamsted		
	8 months old	Old	New	New	Farm Stable- manure	Cake-fed	Not cake-fed
Organic matter . . . . .	20.7 %	28.3 %	22.2 %	19.6 %	20.5 %	—	—
Mineral matter . . . . .	13.1	24.1	30.8	41.3	4.6	—	—
Moisture . . . . .	66.2	47.6	47.0	39.1	74.9	72.6 %	72.8 %
Total dry matter . . . . .	33.8	52.4	53.0	60.9	25.1	27.4	27.2
Total nitrogen . . . . .	0.524	0.563	0.470	0.475	0.442	0.77	0.54
Nitrogen as ammonia . . . . .	0.105	0.140	0.106	0.126	0.10	0.18	0.04
Potash . . . . .	0.82	0.94	0.87	0.53	0.73	0.60	0.67
Phosphoric acid . . . . .	0.20	0.33	0.40	0.31	0.24	0.39	0.23

From these figures, it is evident that army stable manure is very good, being at rich as ordinary farmyard manure in nitrogen, though it falls behind good cake-fed manure. The Army horses are well fed, so that the excreta are rich. Unfortunately, from the farmer's point of view, the stalls are not



designed primarily for the making of manure, and consequently most of the urine is lost, and it is therefore not as rich as bullock manure, made on an equally liberal diet, where the urine is saved. The Army manure contains very little litter, though straw or peat is used, while the method of stabling and collection is such that the solid excreta constitute the larger part of the manure. This is shown in the relative dryness of the Army manure; there is, however, a large proportion of mineral matter, much of which is sand or grit which has been swept up and is of no fertilising value. These impurities rose to 41 per cent. in one sample, the other figures being 13, 24 and 31 per cent. respectively; ordinary farmyard manure contains about 5 per cent. Consequently, the nitrogen, phosphoric acid and potash are not very different in amount from the ordinary figures. The ammoniacal nitrogen content is lower, while the potash content is slightly higher than in ordinary manures. Thus, even apart from its organic matter and its nitrogen, Army manure is specially valuable as a source of potash. In fact, 1 ton of it contains 18 lb. of potash and a dressing of 12 tons contains as much as 15  $\frac{1}{2}$  cwt. of kainit or 3  $\frac{1}{2}$  cwt. of sulphate of potash.

The condition of the manure is all that could be desired, as it is in a finely-divided state in which it can easily decompose in the soil. It should also be noted that there is not much difference between old and new samples, as is the case with farmyard manure. Horse manure exposed to the air loses less nitrogen than farmyard manure. This is partly due to the circumstance that the dumps are made as compact as possible in order to check the breeding of flies and to economise space, and partly to the lower proportion of ammonia present in Army horse manure which therefore does not suffer so great a loss on storage. Another fact may be the actual fixation of nitrogen (1).

The price of Army horse manure in England varies usually from about 1 s. 1  $\frac{1}{2}$  d. to 1 s. 4 d. per ton. In one place it is 2 s. 6 d., but even so, it is cheap, for it is worth at least 5 s. per ton on the farm. In view of the high value of this manure, its use is to be advocated wherever the transport conditions permit.

1905 - Value of Duck Manure. — *Mark Lane Express Agricultural Journal*, Vol. 117, No. 4469, p. 495. London, 1916 (2).

The high value of duck manure is recognised by those who have kept ducks, but does not appear to be appreciated by farmers generally. Upon this question scientific observation is needed, but those who keep large numbers of ducks bear testimony to the remarkable improvement in the herbage of pastures upon which the ducks have been thickly kept for one season, and their practical experience leads to the conclusion that the manurial effect is felt for three or four years. In some instances the number of birds kept is so large that the grass appears to be entirely eaten off, and the

(1) See R. September 1917, No. 797.

(Ed.)

(2) Cf. STORER, F. H. *Agriculture in Some of its Relations with Chemistry*, Vol. I, Seventh Ed., p. 613. New York, 1905.

(Ed.)



earth is quite bare ; the grass, however, springs up luxuriantly the following year, the manure apparently favouring the finer grasses. Hence ducks may have an economic value in the improvement of pastures, apart from any profit which they may yield. Upon farms where fresh ground can be used for the ducks annually they may take the place of larger stock, and avoid the necessity of using so much artificial fertilisers.

1006 - **A New Source of Potash in England.** — I. CRANFIELD, HAROLD, T., A New Source of Potash, in *The Journal of the Board of Agriculture*, Vol. XXIV, No. 5, pp. 526-530.  
— II. Blast Furnace Dust, *Ibid.*, p. 182.

For several years, it has been known to chemists that flue-dust and gases driven off from iron blast furnaces contained an appreciable percentage of potash, but only recently has the suggestion been made in England that these by-products might be of value for agricultural purposes. The suggestion was due to the sudden cutting off of the German exports of potassic salts which had hitherto been the most important source of the potash used by British farmers (1).

The writer has made a preliminary investigation of the flue-dust from several blast-furnaces in the Midlands. He found that the ironstone with which the furnaces are partially fed contains a small percentage of potash ; 3 samples on analysis gave an average of 0.2 per cent. potash. Potash is also present in the fuel, one or two analyses of coal and coke giving figures ranging from 0.15 to 0.4 per cent. of potash. The enormous heat at the base of the furnace appears to break down the potassium silicates, potassium oxide in the gaseous state being formed. This, in turn, reacts with sulphates and chlorides present, producing potassium sulphate and potassium chloride. These potash salts condense in the cooler regions and pass up the furnace in the form of fine dust. The particles become coated with carbon and pass into the main down-flue. At the bottom of this is a cavity which retains the greater bulk of the dust (about 75 to 85 per cent. ) in the form of a coarse, black powder. The finer particles, which contain the greater proportion of potash salts, are carried to the round boilers where the flue-dust is deposited. It is brick-red in colour, and somewhat finer than the black dust. Many of the later-deposited flue-dusts are cream-coloured, and very bulky. They constitute the richest source of potash.

The analyses of the writer give the following data for these different products:

	Total acid soluble potash		Water-soluble potash	
	—		—	
Black dust (5 samples) . . . . .	2.97	5.12 %	1.23	2.01 %
Red dust (2 samples) . . . . .	7.58	8.50	4.68	5.92
Cream dust (2 samples) . . . . .	11.82	15.89	3.69	9.25
Grey dust and light brown dust (3 samples) . . . . .	7.10	12.46	3.82	5.88

(1) See the paper by R. J. WYBOR, *American Institute of Mining Engineers*, February 1917, quoted by the writer. See also R. 1916, No. 623. (Ed.)

The black dusts contain insoluble ferrous compounds. Insoluble sulphides are also present, and occasionally soluble cyanides, sulphites, and even free alkali, in which case the dust should be avoided for agricultural purposes. The red dusts are rich in ferric oxide, while many of the cream dusts contain either free lime or calcium carbonate. All are rich in silica and silicates. The potash exists mainly as potassium sulphate with a smaller proportion of chloride, the remainder being in an insoluble form. The availability of the latter is a subject for urgent investigation. The amount of soluble potash varies much; in samples examined by the writer the variation was between 50 and 70 per cent. of the total potash. After extracting the fine dust with hot water, evaporation of the extract yields a white residue which contains on an average 70 to 80 per cent. of potassium sulphate and chloride, corresponding to 40-42 per cent. of potash ( $K_2O$ ), the principal impurities being sodium chloride and calcium sulphate.

The writer gives a rough approximation of the total amount of potash which could be obtained from the blast furnaces of Great Britain.

Number of furnaces in full blast . . . . .	300
Tons of flue dust produced per furnace per week . . . . .	
Black, with 2 per cent potash . . . . .	20
Red, with 7 per cent. potash . . . . .	5
Cream, with 10 per cent. potash . . . . .	1
Total of tons of potash produced per furnace per week . . . . .	0.95
Total of tons of potash produced per furnace per annum . . . . .	50

This would give for the whole of Great Britain a total annual production of 15 000 tons from the *blast-furnace dust*, of which at least 50 per cent. would represent soluble potash. The writer therefore considers this to be the most important source of potash yet discovered in the country, and until arrangements can be made and plant erected for the extraction of the water-soluble potash salts, the raw fine dust might be utilised on land which has become very deficient in potash during the last 2 years.

It is evidently on account of these facts that the British Ministry of Munitions has issued an order dated August 7, 1917, to the effect that no person shall buy, sell, deal in, or dispose of any blast-furnace dust, except under and in accordance with the terms of a licence issued on behalf of the Minister of Munitions by the Controller of Potash Production.

1007 - **Production of Nitrates by the United States Government.** — I. Nitrate Supply Committee Recommendations on Synthetic Nitric Acid for the Government with Reports on Various Methods. *The Journal of Industrial and Engineering Chemistry*, Vol. 9, No. 9, pp. 829-841. Easton, Pa., September 1, 1917. — II. Production of Nitrates by the Government. *Science*, N. S., Vol. XLVI, No. 1185, pp. 250-258. Lancaster, Pa., September 14, 1917.

The United States War Department gives an account of its preparations for the production of nitrates in accordance with a report filed by the Nitrate Supply Committee.

The Nitrate Supply Committee, appointed by the U. S. Secretary of War, was under authority of a provision in the national defence act for an



investigation "to determine the best, cheapest and most available means for the production of nitrates and other products for munitions of war and useful in the manufacture of fertilizers and other products".

The general recommendations, dated May 11, 1917, of the Nitrate Supply Committee are reported as follows :

1) The Committee, appreciating the offer of the General Chemical Company, recommends that the government enter into negotiations to acquire the rights to use the synthetic ammonia process of that company.

2) That contingent upon satisfactory arrangements with the General Chemical Company, out of the \$20 000 000 nitrate supply appropriation such sum as may be needed, now estimated at \$3 000 000 be placed at the disposal of the War Department to be used in building a synthetic ammonia plant, employing the said process of the General Chemical Company, and of a capacity of 60 000 pounds of ammonia per 24-hour day, the said plant to be located in a region where land, water, coal and sulphuric acid are cheaply available, where good transport facilities exist, and where the proposed new powder plant of the government can be properly located. In the opinion of this committee all of these conditions just enumerated are best fulfilled by a location in southwest Virginia or some contiguous region.

3) That out of the \$20 000 000 nitrate supply appropriation an amount now estimated at \$600 000, or as much as may be needed, be placed at the disposal of the War Department to be used in building a plant for the oxidation of ammonia to nitric acid and the concentration of nitric acid, of a capacity equivalent to 24 000 pounds of 100 per cent. nitric acid in a 24-hour day, the said plant to be located in the neighbourhood of the aforesaid synthetic ammonia plant and the proposed new powder plant of the government.

4) That the War Department proceed at the earliest possible date with the construction of the oxidation plant and, contingent upon a satisfactory arrangement with the General Chemical Company, also with the synthetic ammonia plant, and that the government give such priority orders as will secure from contractors prompt delivery of the materials and rapid construction of the structure and machinery needed for those plants.

5) The Committee, appreciating the offer of the Nitrogen Products Company granting, in this country, to the government, under certain conditions the right to use the so-called **BUCHER** process for the production of sodium cyanide and ammonia, recommends that a form of contract, drawn with the advice of the legal authorities of the government, such as to give that company no guaranty or exclusive rights in the process, or in its future development, beyond those which the company's own patents give to it, be entered into with the Nitrogen Products Company, and that experimentation looking toward the industrial development of the **BUCHER** process for the production of ammonia be at once proceeded with. And, further, that contingent upon a satisfactory arrangement with the Nitrogen Products Company, a sum not to exceed \$200 000 be allotted for this purpose out of the \$20 000 000 nitrate supply appropriation.

6) That out of the \$20 000 000 nitrate supply appropriation \$100 000 be made available for the active prosecution of investigations of processes for the industrial production of nitrogen compounds useful in the manufacture of explosives or of fertilizers, and that these investigations be planned and supervised by the War Department.

7) That in order to increase the production of ammonia and toluol the government promote the installation of by-product coke ovens by directing that priority be given in the production, delivery, and transportation of the materials and parts needed in their construction.

8) That the decision as to more extensive installation of nitrogen fixation processes and water power development in connection with them be postponed until the plants above recommended are in operation or until further need arises.

9) While the preceding recommendations include all the measures that can now judiciously be taken for the fixation of nitrogen and the oxidation of ammonia, it is the opinion



of the committee that the immediate accumulation and the permanent maintenance of an ample reserve, not less than 500 000 tons of Chile salpeter, is the measure most urgently necessary.

The Nitrate Supply Committee comprised U. S. Army and Navy officers, representatives of the Bureau of Soils, U. S. Department of Agriculture, of the Bureau of Standards, U. S. Department of Commerce and of the Bureau of Mines, Interior Department, as well as scientific men and engineers.

1008 — **The Presence of Arsenic in Hops, in the United States.** — STOCKBERGER, W. W. (Physiologist in Charge of Drug-Plant and Poisonous-Plant Investigations, Bureau of Plant Industry), and COLLINS, W. D. (Food-Investigation Chemist, Bureau of Chemistry), in *U. S. Dept. of Agriculture, Bulletin No 568, Joint Contribution, from the Bureau of Chemistry and the Bureau of Plant Industry, Professional Paper. 7 pp.* Washington, D. C., August 8, 1917.

AGRICULTURAL  
BOTANY,  
CHEMISTRY  
AND  
PHYSIOLOGY  
OF PLANTS

Traces of arsenic having been occasionally found in consignments of hops exported from America, the consignments were refused. This had a bad effect on the production of hops in the United States, as the profit largely depends on the possibility of exporting the excess of production over the home-consumption requirements.

Experiments made on sun-dried hops from various hop-gardens of Oregon in 1915, showed that, practically speaking, no arsenic was present. Analyses of the various sprays ordinarily used for fungus control (whale-oil soap, quassia wood, nicotine sulphate) showed that there was no possibility of arsenical contamination being derived from them. On the other hand, the sulphur used for bleaching the hops produced in 1914 and 1915 usually appears to contain arsenic as an impurity. In fact, a large number of samples were found to contain more than 100 millionths of arsenic anhydride. It is thus quite possible that hops treated with such sulphur could contain about 3 or 4 millionths of arsenic.

It is perfectly clear that the impure sulphur used for bleaching is the sole cause of the contamination of the hops with appreciable amounts of arsenic, and this confirms previous supposition.

1009 — **The Presence of Nitrites and Ammonia in Diseased Plants.** — I. BONCQUET, P. A., in *The Journal of the American Chemical Society*, Vol. XXXVIII, No. 11, pp. 2572-2576. Easton, Pa., November 1916. — II. BONCQUET, P. A., and BONCQUET, M., *Ibid.*, Vol. XXXIX, No. 9, pp. 2088-2093. Easton, Pa., September 1917.

I. — This work shows that in the extracted juices of plants infected with diseases of the so-called physiological type, such as curly leaf of sugar beets, curly dwarf of potatoes (1), mottled leaf of potatoes (2), mosaic disease of tobacco (3), the presence has been detected of nitrites and ammonia which are supposed to be due to the reduction by bacterial action of the nitrates absorbed from the soil.

(1) See *B.* 1914, No. 575. (2) See also *R.* 1916, No. 1225. (3) See *B.* 1915, No. 554.  
(Ed.)

This opinion is based on the fact that the presence of nitrate-reducing bacteria in the plant tissues runs parallel with the presence of nitrites and ammonia in diseased plants.

It is also believed that lack of crop rotation increases the virulence of the reducing bacteria and gives these organisms a better opportunity of establishing themselves in the tissues of plants. By this means, the crop is so much decreased that it might be supposed that the soil was depleted, whereas the nitrogen starvation is due to the bacterial activity in the plants which brings about internal nitrate-reduction.

II. — In the second paper, the facts reported seem to corroborate the idea of nitrogen starvation of plants by the bacterial reduction of nitrates to nitrites and ammonia, after they have been taken up by the roots. In all these diseases, similar phenomena occur in the parts affected; this similarity is especially noticeable if the cell is considered as an unit of life.

The response to this stimulus is so strong as to manifest itself in biochemical, physiological, and even morphological, changes. All these responses and adaptations apparently have in view the one end of supplying the necessary nitrogen to the plant cell. This increase of biological activity, however, is in itself a pathological phenomenon. As the disease progresses, the symptoms of nitrogen starvation become more and more apparent, till the plant finally makes no further progress in growth, but completes its life cycle in a dwarfed condition, or dies before reaching maturity.

However, in plants inhabited by nitrate-reducing organisms such as *Bacillus morulans*, in sugar-beets affected with curly leaf, *Streptococcus Solani*, in potatoes attacked by mosaic disease, the biological, physiological and morphological phenomena seem to work in harmony for the preservation and increase of the nitrogen content of the tissues. Preservation seems to be the aim and object of the oxidizing enzymes which tend to neutralise the reducing action of the bacteria. The biochemical phenomena appear to be the first to respond to the stimulus of the invader. Amongst these the first noticeable are the decrease and subsequent increase of the oxidases. The diastases also increase and are localised in the tissues owing to the stimulus of the internal reducing-bacteria. The formaldehyde content increases noticeably in the juices of diseased beetroot leaves; this phenomena, however, has not yet been sufficiently studied to permit the drawing of conclusions. In the leaves of tobacco plants affected with mosaic, the starch content increases to correspond with the greater chlorophyll activity due to the stimulus. Sugar beets affected with curly leaf have, as a rule, a higher sugar content in the roots than normal beets. Morphological adaptations, such as the reduction in size of secondary organs, that occur after infection, seem to economise the nitrogen and preserve it for the more essential parts of the plant, such as roots and leaves. The increased tendency to supply the plant with the nitrates necessary for the building up of the tissues, seems to be demonstrated by the fact that the plant uses more water per unit of dry weight, and also by the increase of the root system. The consequence of this is,



in all likelihood, an increase in ash content which, if the plant were normal, would mean most probably an increase in total nitrogen. The fact, however, that no matter how well the plant has succeeded in absorbing a surplus of water from the soil, a deficiency of total nitrogen is found in the tissues, suggests the idea that the bacteria, in reducing nitrates to nitrites and ammonia, have wasted this necessary element, thus bringing about a disease of nitrogen starvation. A disease which also seems to present all the morphological adaptations to nitrogen starvation is the bramble leaf disease of the vine (1).

1010 - **Self-Sterility in Plants.** — MOORE, C. W., in *The Journal of Heredity*, Vol. VIII, No. 5, pp. 203-207. Washington, May, 1917.

The object of the work was to find some clue as to the nature or cause of self-sterility, the term being taken to mean that the pollen of a flower is not capable of fertilising the ovules of the same flower, while being capable of fertilising the ovules of another plant. The distinction was made to distinguish between plants having abortive pollen or ovules, and plants having self-sterile flowers.

Various plants said to be self-sterile were grown and the stigma and style were examined. The plants used for the experiments were *Tradescantia*, alsike clover, alfalfa, and the Shirley poppy (*Papaver rhoeas*).

On 12 plants of *Tradescantia*, 83 self-pollinations were made, but none of them set seed; 26 cross-pollinations were made and all of them produced seed. A microscopical examination of the styles showed that, while the self-pollinated flowers showed good germination of the pollen, yet the pollen tubes did not grow down the style. Self-sterility, in this case, appears to be due to failure of the pollen tubes after germination.

Careful measurement of the diameter of the pollen tubes showed that while the diameter of those from self-pollination was, on an average, 0.0216 mm., it was only 0.0144 mm. in the case of pollen tubes from cross-pollination. This difference in diameter was shown not to be so great as to prevent growth of the pollen tube down the style, since the smallest tube from a self-pollination had the same diameter as the largest from a cross-fertilisation.

The results obtained from the three other plants are shown in the following table, those from *Tradescantia* being included for the sake of comparison.

*Results of the self-pollinations and cross-pollinations.*

Plants	Number of Plants used	Self-pollination		Cross-pollination	
		No. of flowers pollinised	Percent. of flowers setting seed	No. of flowers pollinised	Percent. of flowers setting seed
<i>Tradescantia</i> (sp. and hybrid) .	12	83	0 %	26	100 %
Alsike clover . . . . .	14	1452	2.75	1437	21.5
Alfalfa . . . . .	8	1459	27.10	822	38.7
Shirley poppy . . . . .	70	86	39.50	75	84.0

(1) See *B.* 1914, No. 681; *R.* 1916, No. 1029.

(1*d.*)



From the above table it will be seen that *Tradescantia* was completely self-sterile, while alsike clover, and alfalfa showed varying degrees of self-sterility. With the Shirley poppy, since but 84 % of the crosses set seed, it is possible that a number of the plants may have been cross-sterile.

From a morphological standpoint the pollen tube of the angiosperm has two functions: 1) the transferring of the male generative nucleus to the embryo sac, and 2) the function of growth, which is one of food assimilation. In the manner of assimilation the pollen tube acts in a similar manner to the mycelium of a fungus.

The writer next considers the theories put forward by various workers (COMPTON, CORRENS, EAST) on self-sterility, and thinks that COMPTON's hypothesis, that self-sterility in plants may be analogous with wheat which is immune to the rust-fungus, seems very probable. The hypothesis is that, in the attack of immune wheat plants by rust, the tissue is immediately killed. The fungus, being an obligate parasite, cannot live in the dead host tissues and so dies. Applying the analogy to self-sterility, the self-pollen tube is in a better medium for food assimilation, and therefore does not grow so quickly as a cross-pollen tube where the medium is less suitable to it. The cross-pollen tube is assumed to continue growth in order to obtain a better food supply.

It thus seems that the greater width of the self-pollinated pollen tubes is due to the fact that the food supply is more favourable to the nourishment of a self-pollen tube than it is to a cross-pollen tube. On account of the abundant food supply the pollen tubes did not lengthen, but grew wider since they were in such a favourable medium. By this hypothesis it is possible to explain most of the above data with regard to self-sterility and it is not contrary to any cytological evidence.

1011 - The Behaviour of the Hybrids *Avena sativa patula* var. *Victor* × *Avena sativa nuda* var. *inermis*. — ZINN, JACOB, and SURFACE, M. FRANK, in *Journal of Agricultural Research*, Vol. X, No. 6, pp. 293-312, Plates 39-47. Washington, 1917.

This paper contains a description of the  $F_1$  and  $F_2$  generations of a cross between two subspecies of oats which possess several contrasting characters: *Avena sativa patula* var. *Victor* and *Avena sativa nuda* var. *inermis*. The first of these is characterised by the presence of flowering glumes (*palaeae*) which adhere closely to the caryopsis ("hulled grain"), by the biflorous spikelets, black colour of the glumes, strong awns, and a long, but rather sparse, pubescence at the sides of the base of the lower grain.

*Avena sativa nuda* var. *inermis* has, on the contrary, the following characteristics, loose, membranous and detached glumes; multiflorous spikelets; white or light yellow glume colour; almost total absence of awns, and absence of pubescence at the base of the grain.

The  $F_1$  generation is distinctly intermediate. In regard to the glumes, both naked and firmly hulled grain, as well as intermediate forms, are found in the same panicle, and even in the same spikelet. The spikelets near the top of the panicle are either entirely naked, or nearly so, while those spikelets at the base tend to be firmly hulled.

Regarding the inheritance of grain colour, there are some black and some yellow individuals, in the ratio as 3 : 1, the black pigment thus being dominant.

In the  $F_2$  generation, in addition to the two parental types (naked and hulled), 4 intermediate classes with an evidently heterozygous character were distinguished. The different forms present a simple Mendelian relation of 1 : 2 : 1

*Segregation in regard to hull character.*

	Hulled	Intermediate	Naked
Observed . . . . .	221	404	229
Expected . . . . .	213.5	426	213.5

There is thus a good agreement between the observed and expected results.

The same is the case as regards the grain colour; here black is dominant in relation to white as the following data show:

Observed . . . . .	Black : White = 646 : 208
Expected . . . . .	Black : White = 646.5 : 213.5

The ratio between the black and the white individuals is thus as 3 : 1.

There is no correlation between the determinants of hull character and the grain colour. The ratio between the black and white individuals always remains the same in the hulled, intermediate and hull-less grain. This is clearly shown by the following table:

	Hulled		Intermediate		Hull-less	
	Black	White	Black	White	Black	White
Observed . . . . .	166	55	296	108	184	45
Expected . . . . .	160.1	53.4	320.3	106.8	160.1	53.4
Ratio	3 : 1		3 : 1		3 : 1	

As regards the pubescence at the base of the grain, this character is sometimes much more developed in some of the  $F_1$  hybrids than in the parent *Avena sativa patula* var. *victor*. The writer explains this fact by assuming that the character of complete pubescence is due to the action of 2 factors, A and T; the first, A, which belongs to *Avena sativa patula*, gives a slight, thin pubescence; the second, T, which is present in *Avena sativa nuda*, has no effect by itself, but in conjunction with A, it determines a higher degree of pubescence with a maximum in individuals homozygous for A and T.

Composition of  $F_2$  Hybrids

		Male Gametes of $F_1$			
		AA	AT	TA	TT
Female Gametes of $F_1$	AA	AA AA	AT AA	TA AA	TT AA
	AT	AA AT	AT AT	TA AT	TT AT
	TA	AA TA	AT TA	TA TA	TT TA
	TT	AA TT	AT TT	TA TT	TT TT
		Zygotes of $F_2$			

The  $F_1$  hybrid, which has the formula A A T T, produces 4 kinds of gametes: A A — A T — T A — T T, which, in  $F_2$ , may give 16 combinations (see Table). Among these, one only, T T T T, is completely free from pubescence; all the others, in fact, have a factor A. Out of 323  $F_2$  individuals, 300 were pubescent and 23 smooth (theoretically: 302.8 and 20.2), according to the ratio 15 : 1

There is no correlation between the colour of the grain and the pubescence at the base of the grain.

The quantity and quality (weak and little developed, strong and much developed) of the awns in crossing experiments depend, not only on the presence of special determinants, but also on the morphological constitution of the lower flowering glumes. In naked forms (where the glume does not adhere to the grain) with membranous flowering glumes, the awned character can only appear when the determinant is present. Taking only the types of hulled grain and intermediate hulled grain, the ratio of strong awned and of weak awned plants is as 3 : 1 (observed 245 : 77; expected 241.5 : 80)

1012 — Hybrids of *Zea Ramosa* and *Zea tunicata*; Experiments Carried out in the United States. — COLLINS, G. N., in *Journal of Agricultural Research*, Vol IX, No. 11, pp. 383-395. Bibliography of 9 Publications. 8 plates. Washington, June 1917.

*Zea ramosa* and *Zea tunicata*, both resulting by mutation from *Zea Mays*, are probably reversions from normal maize toward the general type of grasses, since they have lost the specialization that distinguishes maize from practically all other Gramineae. The writer crossed these two mutants in order to determine the nature and behaviour of their characters, with



the hope that their combination might bring to light still other and latent ancestral characters and help to give him a more definite conception of the ancestors and history of cultivated maize.

The following is a summary of the distinctive characters of the two mutants which were the subjects of the experiment:

I. — *Zea ramosa*: 1) The female inflorescence is not simple, but compound and branched like the male.

2) In normal maize, the terminal male inflorescence bears a number of branches at its base. Above the uppermost branch the axis is continued, with an abrupt transition into the central spike. In the *Z. ramosa* tassel, the branches are much more numerous and gradually decrease in size from the base upwards, the transition from branches to pairs of spikelets being imperceptibly gradual. *Zea ramosa* is a recessive variation, with the dominance of normal maize.

II. — *Zea tunicata*: The glumes of the female inflorescences are developed so that each seed is either completely, or nearly, inclosed; the seed is thus tunicate. The progeny in self-pollinated plants are separable into 2 classes:

Type *a* (*Zea tunicata a*), like the female parent, with typical tunicate ears and thickened tassels;

Type *b* (*Zea tunicata b*), with greatly enlarged tassels containing both staminate and pistillate flowers, and with the ear either aborted, or bearing greatly enlarged and usually sterile spikelets.

The ratio of the 2 types *a* and *b* is as  $2\frac{2}{3} : 1\frac{1}{3}$ .

The *tunicata* type *b* represents the original homozygous form, while *tunicata a* represents the heterozygous form, a cross between normal maize and type *b*.

In 1914, at Lanham, the writer crossed *Zea ramosa* with *Zea tunicata* and obtained (1915) 9 plants in the  $F_1$ . Of these, 4 were tunicate, and 5 normal, with no trace of the *ramosa* characters. The *tunicata* type is thus clearly heterozygous. From 3 tunicate ears 326 plants were obtained by self-pollination (in 1916) in the  $F_2$ , and from 2 ears of the normal type, 82 plants were raised.

The characters of these hybrids of the  $F_2$  were as follows:

The 82 plants from the normal type were divided into 2 groups: 65 normal and 17 *ramosa*, in the ratio of 3:1

The 326 plants obtained from the tunicate ears represented a completely heterogeneous mixture of the characters of the 2 parents, but 5 types could be distinguished: 1) normal; 2) *tunicata a*; 3) *tunicata b*; 4) *ramosa*; 5) *tunicata ramosa*. In the last group, some individuals presented an entirely new type of inflorescence, where the tissues were still in an embryonic condition and continued dividing, so that the ramifications went on being produced throughout the growing season, the result being a white succulent mass without any trace of floral or foliar organs.

The writer explains the numbers in which the various classes of plants occur by the assumption of a comparatively simple gametic composition, and gives the following formulae:

TABLE I. — Possible combinations in the  $F_2$  of the hybrid between *Zea tunicata* and *Zea ramosa*.

		Male gametes of the $F_1$			
Female gametes of $F_1$	♂	TR	T R'	T' R	T' R'
	♀				
	TR	TR TR <i>tunicata b</i>	T R' TR <i>tunicata b</i>	T' R TR <i>tunicata a</i>	T' R' TR <i>tunicata a</i>
	TR'	TR T R' <i>tunicata b</i>	T R' T R' <i>tunicata-ramosa</i>	T' R T R' <i>tunicata a</i>	T' R' T R' <i>tunicata-ramosa</i>
	T' R	TR T' R <i>tunicata a</i>	T R' T' R <i>tunicata a</i>	T' R T' R normal	T' R T' R normal
	T' R'	TR T' R' <i>tunicata a</i>	T R' T' R' <i>tunicata-ramosa</i>	T' R T' R' normal	T' R' T' R' <i>ramosa</i>
Zygotes of $F_2$					

TABLE II. — Composition of the  $F_2$  of the hybrid between *Zea tunicata* and *Zea ramosa*.

Number expected of each 16	Gametic Composition	Characters of plant	Expected Number	Observed Number
1	T' T' R R	normal	61.2	64
2	T T' R R'	»		
2	T T' R R	<i>tunicata a</i>	122.0	121
4	T T' R R'	»		
1	T T R R	<i>tunicata b</i>	61.2	61
2	T T R R'	»		
1	T T R' R'	<i>tunicata-ramosa</i>	61.2	64
2	T T' R' R'	»		
1	T' T' R' R'	<i>ramosa</i>	20.4	16
Total 16			326.0	326

To *Zea tunicata* *b*, may be assigned the formula **T<sub>1</sub>RR**, where **T** = the tunicate factor, and **R** = the inhibiting factor which prevents the appearance of the characters of *Z. ramosa*.

The formula assigned to *Zea ramosa* would then be **T'T'R'R'**, where **T'** = the absence of the determinant **T**, and **R'** = the absence of the inhibiting factor **R**. The formula for *Zea Mays* would be **T'T<sub>1</sub>RR**. For *Zea tunicata* *a* (*Zea tunicata* × *Zea Mays*), formula **T<sub>1</sub>T<sub>1</sub>RR**.

From the cross *Zea tunicata* *a* × *Z. ramosa* (made by the writer in 1914), there should be obtained 2 types of plants: **T<sub>1</sub>T<sub>1</sub>RR'** and **T'T<sub>1</sub>RR'**, neither being of the *ramosa* type on account of the presence of **R**.

The hybrid **T'T<sub>1</sub>RR'**, having the characters of ordinary maize, produces 2 kinds of gametes: **T'R** and **T'R'**, which give, in the *F*<sub>2</sub>, 4 combinations: **T<sub>1</sub>RT<sub>1</sub>R** — **T<sub>1</sub>R'T<sub>1</sub>R** — **T<sub>1</sub>RT'R'** — **T<sub>1</sub>R'T'R'** — of which the 3 first are normal (ordinary type) and the last is the *ramosa* type.

The hybrid **T<sub>1</sub>T<sub>1</sub>RR'** (*tunicata* *a*) will give, on the contrary, 4 different gametes — **TR** — **T'R** — **TR'** — **T'R'** — and, in the *F*<sub>2</sub>, 16 different combinations (see Table I). All the plants either heterozygous or homozygous for **R** and homozygous for **T** would be normal. All plants homozygous for **R'** would be *ramosa*. Those heterozygous for **T**, and with at least one **R**, would be half tunicate (*tunicata* *a*). Those homozygous for **T**, and with at least 1 **R**, would be full *tunicata* (*tunicata* *b*).

In Table II, the 326 individuals of the *F*<sub>2</sub> obtained in 1916 (self-pollinated ears of the type *tunicata* *a*) are divided into different categories. Next to the expected numbers are placed the observed numbers; the two values correspond almost exactly.

The writer had hoped in the course of his experiments to be able to individualise and define new ancestral characters which would enable him to reconstruct the original ancestor of cultivated maize, but from this point of view the results were negative; for the hybrids only showed a completely heterogeneous mixture of the *ramosa* and *tunicata* characters, since no phylogenetic value could be attributed to the grotesque inflorescences, mere monstrosities, mentioned above. The writer's careful experiments, however, allowed us to form a clear idea of the nature of the two mutants, the one, *ramosa*, recessive, the other, *tunicata*, dominant, as compared with the normal type. The result of crossing these two mutants has been to show that both behave as independent Mendelian units according to a hypothesis put forward by the writer and corresponding exactly to the conditions observed in the course of the experiments.

1013 - The Colour of the Seed in the Descendants of a Natural Hybrid of Two Varieties of *Phaseolus vulgaris*, in Sweden. — LUNDBERG, JOHN and AKERMAN, A., in *Sveriges Utsädesförenings Tidskrift*, Year XXVII, Pt. 3, pp. 115-121. Malmö, 1917.

Among the descendants of a pure line of dwarf beans with chocolate coloured seed (isolated from a plot of the "Prinzess" variety with yellow-brown seeds) there was noticed, in 1913, a plant which was distinguished by its dark brown colour. From this plant, clearly a heterozygote, 3 different types were obtained in 1914, namely:



- 6 individuals with dark brown seeds, like the parent plant,
- 4 individuals with yellow-brown seeds, like the original variety.
- 1 individual with chocolate coloured seeds.

In the following generations,  $F_2$  (1915) and  $F_3$  (1916), these characters were carefully studied in order to ascertain whether they remained constant or broke up into two or more groups in accordance with constant numerical ratios.

The principal results of these investigations may be summarised as follows:

1) The dark brown colour of the seeds of the mother plant remains constant in some of the descendants, but in the others it breaks up into:

- a) dark brown and chocolate colour, or
- b) dark brown and yellow-brown, or
- c) dark brown, chocolate colour, yellow-brown and yellowish-white.

2) In plants with chocolate colour seeds, this character is either preserved, or else it breaks up into chocolate colour and yellowish-white, but individuals with dark yellow seeds are never produced.

3) The dark yellow colour either remains constant or splits up into yellow-brown and yellowish-white, according to the ratio 3 : 1.

4) The yellowish-white colour remains constant.

The author explains these phenomena by the existence of two determinants, **G** for the yellow-brown (characteristic of the "Prinzess" variety), epistatic for the yellowish-white substratum, and **C** for the chocolate colour. The gametic composition of the various types when homozygotic should, therefore, be:

- CCGG** . . . . . dark brown seeds.
- CCgg** . . . . . chocolate colour seeds.
- ccGG** . . . . . yellow-brown seeds.
- ccgg** . . . . . yellowish-white seeds.

If **ccGG** is crossed with **CCgg**, the hybrids of the 1st. generation will have the formula **CcGg** (this was the case with the dark brown seeds isolated in 1913). In the 2nd. generation, as may be seen from the appended diagram, there may be four types: 1) with dark brown seed; 2) with chocolate colour seed; 3) with yellow-brown seed; 4) with yellowish-white seed; in the ratio 9 : 3 : 3 : 1. In reality, the yellowish-white type was absent, on account of the few plants studied and the rareness of the combination **ccgg**.

Diagram of the various gametic combinations possible in  $F_2$ .

Male gametes of  $F_1$

Female gametes of $F_1$	♂	CG	Cg	cG	cg	Zygotes of $F_2$
	CG	CC GG dark brown	CC Gg dark brown	Cc GG dark brown	Cc Gg dark brown	
	Cg	CC Gg dark brown	CC gg chocolate colour	Cc Gg dark brown	Cc gg chocolate colour	
	cG	Cc GG dark brown	Cc Gg dark brown	cc GG yellow-brown	cc Gg yellow-brown	
	cg	Cc Gg dark brown	Cc gg chocolate colour	cc Gg yellow-brown	cc gg yellowish-white	

Zygotes of  $F_2$

1014 — The Effects of Age on the Hybridisation of *Pisum sativum*: Researches in Austria. — ZEDERBAUER, E., in *Zeitschrift für Pflanzenzucht*, Vol. V, Pt. 2, pp. 257-259. Berlin, 1917.

Two varieties of peas were used in this experiment: 1) "Wunder von America" with green, wrinkled, angular seed; 2) "Auslös de grâce", with yellow, smooth, round seed. Plants of different ages were crossed by fertilising the first flower of a "Wunder von America" with the pollen of the last flower (the oldest) of an "Auslös de grâce". Four wrinkled, angular seeds of a greenish-yellow colour were obtained, showing predominance of the characters of the mother plant. This is also observed in the  $F_2$  and  $F_3$  generations, as may be seen from Table I.

TABLE I. — Cross between individuals of different ages. Characters of the seeds and their distribution in  $F_2$  and  $F_3$ .

	Yellow seeds	Greenish-yellow seeds	Green seeds	Green seeds with yellow spots	Smooth seeds	Pale-yellow seeds	Wrinkled seeds
Number of seeds:							
in $F_2$ . . . . .	0	0	194	30	0	0	224
in $F_3$ . . . . .	5	419	6 590	503	33	16	7468
Percentages:							
in $F_2$ . . . . .	0 %	0 %	86.3 %	13.7 %	0 %	0 %	100 %
in $F_3$ . . . . .	0.1	5.6	87.6	6.7	0.5	0.2	99.3

The 7517 seeds of the 3rd. generation were all indistinctly angular; 32 were green and smooth; 4 were yellow and wrinkled; 1 only was yellow and smooth. The dominance of the maternal group of green, wrinkled seeds is, therefore, evident.

If, however, individuals of equal ages (first flower of both parents) are crossed, the results given in Table II are obtained.

TABLE II. — Cross between individuals of equal ages. Characters of the seeds and their distribution in  $F_2$  and  $F_3$ .

	Yellow seeds	Greenish-yellow seeds	Green seeds	Smooth seeds	Wrinkled seeds
<i>Number of seeds:</i>					
in $F_2$ . . . . .	120	2	31	106	47
in $F_3$ . . . . .	1 008	—	541	1 039	610
<i>Percentages:</i>					
in $F_2$ . . . . .	79%	1%	20%	70%	30%
in $F_3$ . . . . .	64	—	36	67	33

Table II shows that, in this case, the paternal characters (smooth yellow seeds) become dominant.

The age of the individual, therefore, has a quite definite influence on the phenomena of hybridisation. The characters of young individuals, usually recessive, tend, when crossed with an older one, to assert themselves gradually more and more till, finally, they become completely dominant.

1015 — The Improvement of Native Vines by Crossing and Selection in the United States. — DEARING, CHARLES, in the *Journal of Heredity*, Vol. VIII, No. 9, pp. 409-424, fig. 10-18, Washington, D. C., 1917.

In the South East region lying between the slopes of the Appalachian Mts. and the Atlantic Ocean, cultivated varieties of *Vitis vinifera* will not grow, on account of the want of soil drainage, and the moisture and excessive heat. The only vines that succeed are some types of native vines known under the generic name of "Muscadine Grape" and belonging to the two species *V. rotundifolia* and *V. Munsoniana*. In addition to their adaptation to the climate and unfavourable conditions of their environment, these vines are also distinguished by the following characters:

- 1) Vigorous growth, and special resistance to diseases and insects;
- 2) late and prolonged blooming season which insures a regular crop and uniform yield;
- 3) productive period of 100 years, or even longer.

On the other hand, however, these vines have small bunches, the fruit has a low sugar content, the pips are large, and what is of more importance, the plants are dioecious, which reduces the percentage of fruit set. With a view to improving the production of grapes used for wine-making and for the table in North Georgia and the neighbouring zones, the Bureau of Plant Industry of the Department of Agriculture of the United States



undertook a series of experiments and investigations, in the vineyards belonging to the Willard (N. C.) Agricultural Experiment Station. The results hitherto obtained have been most promising. The object of these studies was twofold: 1) to improve, by means of crossing and suitable selection, the cultivated kinds of *Muscadinia*, and to eliminate undesirable characters; 2) to try to cross *Muscadinia* with *Vitis vinifera*, with the intention of uniting in a single type the excellent qualities of *V. Vinifera* and the resistance of the native vines to bad climatic conditions.

A. — IMPROVEMENT OF NATIVE VINES. One of the most striking results has been the creation of self-pollinating kinds with complete, hermaphrodite flowers which allow of a type with well-known fruit characters being multiplied without any recourse to a male plant of which the fruit characters are necessarily unproved. The introduction of self-pollinating types presents additional advantages: a) a perceptible increase in the percentage of fruits set, this being from 25 to 50 per cent., while in the case of self-pollinated varieties, the maximum is given by "Flowers" with 15 per cent.; b) the elimination from the vineyards of male vines which take up space without producing any grapes; c) a considerable increase in the size of the bunches; all these improvements increase the yield.

The two original hermaphrodites  $H_1$  and  $H_2$  were produced, the first at New-Smyrna, Florida, by crossing the "Eden" variety (a "Muscadine") with a wild individual of *V. Munsoniana* bearing coloured grapes of a dark hue, and the second, at Medoc Vineyard, Enfield, N. C., by crossing "Scuppernong" with a wild male plant with white (colourless) fruit.

B. — CROSSING EXPERIMENTS WITH *Vitis vinifera*. As regards the hybrids actually obtained, since the plants have not yet borne grapes, little can be predicted concerning their practical utility. However, stress should be laid upon the great scientific importance of this work in which very serious technical difficulties have been overcome, and which has resulted in the union in a single individual of two "uncongenial" groups like *Euvitis* and *Muscadinia*. The hybrid nature of the offspring is proved by the presence of two types of botanical characters, as is shown by the examination of the tendrils, these being simple in *Muscadinia*, and bifurcated in *Euvitis*; while in the hybrids, we meet with simple and ramified tendrils on the same individual at the same time.

The kind of *Muscadinia* which most resembles *V. vinifera* is, without doubt, the Thomas variety. The latter can be fairly easily crossed with *Roditis*, *Carignan*, and *Noah*, and produces stable, vigorous hybrids. Of the other vines of the *Euvitis* group that have been used with success, we should mention; Winchell, Olivette de Vendemain, Merveille de Malaga, Muscat d'Alexandrie, Calabrese, Ferrara, Sémillon, White Hanepoot, Prune de Cazouls, Huasco, Goethe, Brillant, Catawba, Iona and Ives.

The hybrids in question have not yet borne fruit, nevertheless, we may confidently expect that the introduction of the elements of *Euvitis* will bring about a considerable improvement in the native vines, if only as far as the

1017 - **Observations on Manitoba Wheat in Algeria in 1917.** — THE BROTHERS GAY, in *Bulletin Agricole de l'Algérie-Tunisie-Maroc*, 2nd. Series, Year 23, No. 9, pp. 181-182. Algiers, September, 1917.

The following observations were made by the brothers GAY on the cultivation of Manitoba wheat at Berrouaghia (Algeria) in 1917.

Date of sowing: 3rd. April, 1917; area sown: 15  $\frac{1}{2}$  acres; quantity of grain sown: 1 045 lbs.; date of harvest: 27th. July; yield of grain: 952 cwt.; weight per bushel: 63 lbs.

The wheat was broadcast in a very wet, clay loam, about 67 lbs. of grain per acre being used. The grain used was neither very fine nor uniform.

In spite of very unfavourable climatic conditions (particularly violent and continuons sirocco during the flowering and ripening) the 1 045 lbs. of Manitoba wheat sown gave a yield of 952 cwt. of grain. This result is of great interest when compared with the yield of native wheat, and when account is taken of the lateness of sowing (the seed only reached Algiers on the 23rd. March) in the Berrouaghia district, where the climate changes suddenly from very hot to very cold

FORAGE CROPS  
MEADOWS  
AND PASTURES

1018 - **Composition and Food Value of *Andropogon tener*; Investigations in Brazil.** — D'UTRA, G., in *Secretaria da Agricultura, Commercio y Obras públicas do Estado de São Paulo, Boletim de Agricultura*, 18th. Series, No. 6, pp. 374-376. São Paulo, June 1917.

*Andropogon tener* Kunth. (syn.: *A. campestris* Kunth. and *A. Neesii* Trin.) grows wild in many states of Brazil (São Paulo, Minas Geraes, Rio de Janeiro), where it is used not only as pasture, but also as litter and for stuffing mattresses. As the culms and leaves are very thin they are easily made into hay. The plant, being very fibrous, has not a great feeding value. This has been confirmed by analyses, made by the Agricultural Institute of the State of São Paulo, of samples from Itararé. The results obtained are given below.

*Composition and Food Value of Andropogon tener.*

	In the fresh material	In the dry material
1) <i>General analysis:</i>		
Moisture . . . . .	45.39 %	—
Nitrogen . . . . .	2.71	4.96 %
Fat. . . . .	1.03	1.88
Nitrogen-free extract. . . . .	27.71	50.75
Fibre . . . . .	20.42	37.39
Ash . . . . .	2.74	5.02
2) <i>Digestible matter:</i>		
Nitrogen . . . . .	1.90 %	3.47 %
Fat. . . . .	0.67	1.22
Nitrogen-free extract. . . . .	21.80	40.09
Fibre. . . . .	14.09	25.70
Organic matter . . . . .	48.55	70.57
Nutritive ratio. . . . .		1 : 12.5

*Composition of ash:*

Sand and silicic acid . . . . .	75.76 %
Phosphoric acid . . . . .	1.50
Potassium oxide . . . . .	12.66
Calcium oxide . . . . .	4.01

1019 - *Panicum racemosum*, a Wild Forage Plant of Brazil. — DA SILVA LUIZ, in *Secretaria da Agricultura, Commercio y Obras públicas do Estado de São Paulo, Boletim de Agricultura*, 18th. Series, No. 6, p. 451. São Paulo, June 1917.

*Panicum racemosum* Spreng (syn. *P. reptans* Kunth.) grows wild in Brazil in the States of São Paulo and Rio de Janeiro, in the Antilles, where it is known as "grana de Castilla", in Uruguay, near Montevideo. In Brazil the plant does not appear to have any special popular name, but is known as "capim", the same given to forage Gramineae in general. All kinds of live-stock eat it, and it grows in the meadows and along the road-sides. When in full flower it reaches a height of 27 ½ inches. Its cultivation in the state of São Paulo is advised.

1020 - *Hedychium coronarium* in Brazil (1). — BEADLE, CLAYTON, in *Royal Botanic Gardens, Kew, Bulletin of Miscellaneous Information*, No. 3., pp. 104-105. London, 1917.

FIBRE CROPS

The writer recently undertook a journey to Brazil to see the extent to which *Hedychium coronarium* has been established there and also to investigate the possibilities of using it for paper-making in that country and elsewhere. He found that the plant is fairly well-known in certain low-lying lands in the State of Rio Janeiro, although not particularly abundant. In the neighbourhood of the town of Rio Janeiro itself, the writer procured specimens which grew to a height of 10 or 12 feet. The district where *Hedychium* is especially plentiful is in the low-lying lands in the State of Parana, the most abundant supplies being centred round Morretes. In this district, *Hedychium* grows along the railway line which winds up to Curitiba up to an elevation of at least 1000 ft. The size of the plant seems to diminish as one rises, until it disappears altogether at an elevation of 1500 ft. Its normal height in the regions of the plains is about 5 ft. *Hedychium* seems to grow most vigorously after the ground is burnt over to clear it for sugar-cane.

Experiments with a view to its cultivation in the State of Rio, particularly on land that has been cleared and used for sugar-cane, show very promising results. The plant grows strongly all the year, and the ground underneath is more or less choked with the débris of dead stems. The writer did not see any *Hedychium* in his journey through the most southerly part of Brazil, in Uruguay, Argentina, and up the Chilian and Peruvian Coasts.

He extracted the fibre from the green plant by mechanical means, imitating methods that would be employed in the preparation of the fibre for textile purposes, and came to the conclusion that a far whiter fibre may be extracted than has hitherto been obtained, by taking fairly simple precautions.

(1) See also: *B.* 1913, No. 310; *B.* 1915, No. 135; *R.* 1916, No. 266.

(Ed.).



## CROPS

YIELDING OILS,  
DYES,  
TANNINS, ETC.

1021 - **Indigo Cultivation in Honduras.** — DYER, F. J., in *Commerce Reports*, No. 206 p. 861. Washington, D. C., Sept 4, 1917.

The war-time demand for dyestuffs has revived the ancient indigo industry of Central America. Honduras had never wholly abandoned the cultivation of indigo, for although it ceased to yield a profit as an export product, in competition with the synthetic output of commercial laboratories, it is still found in general domestic use among the people. The processes are crude, however, but if the industry could be assured of a satisfactory future, improvement would be feasible.

The centre of the indigo industry in Honduras is around Camasca, which is in the southern portion of the Republic, close to the border of Salvador. The product is marketed in Salvador, and does not show in the export returns of Honduras. The acreage in indigo around Camasca had increased from 1 367 manzanas in 1916, to 3 585 manzanas in 1917 (manzana = 1.72 acres). The production, even with the primitive methods of cultivation and extraction in use, is about 30 pounds of indigo per manzana, so that the output of this small district should approximate 100 000 pounds for 1917.

STIMULANT,  
AROMATIC,  
NARCOTIC,  
AND  
MEDICINAL  
CROPS

1022 - **Cassia Tora, a New Coffee Adulterant Examined at Poona, British India.** — TAMHANE, V. A., in *The Poona Agricultural College Magazine*, Vol. IX, No. 1, pp. 47-49. Poona, July 1917.

A number of samples have recently been received in the Laboratory of the Agricultural Chemist, Bombay, Poona, under the names of "artificial coffee", "swadeshi coffee", "coffee substitute", etc. These were sent for analysis and report as to whether they were nutritious and harmless. Microscopic examination revealed that the samples were obtained by roasting and crushing the seeds of *Cassia Tora* (called "takla" locally and "kuvadia" in Gujarati) which is a shrub commonly found in the fields in the province of Bombay, where it grows to the height of 1 to 3 ft. This substitute for coffee has the appearance of ground roasted coffee; the aroma, however, is not quite the same. The drink made from the seeds of *Cassia Tora*, though differing in taste from true coffee, is not unpleasant. The ether extract contains the glucoside emodin ( $C_{15}H_{10}O_5$ ) of which the true nature is not fully known, but it is supposed to be harmless. The chemical composition of the roasted seed of *Cassia Tora* is as follows:

*Composition of Roasted Seed of Cassia Tora.*

	%
Water . . . . .	6.45
Ether Extract . . . . .	8.25
Albuminoids . . . . .	20.00
Soluble Carbohydrates . . . . .	49.05
Woody Fibre . . . . .	11.05
Ash . . . . .	5.20
	<hr/>
	100.00

1023 - Adulteration of Seeds of *Illicium anisatum* with those of *Illicium religiosum* and Cases of Poisoning Due to the Use of the Latter, in the Philippines. — See No. 989 of this *Review*.

1024 - The Cultivation of Pepper-Vines at Banka, Dutch-East-Indies. — See No. 1083 of this *Review*.

1025 - Experiments on the Manuring of Tobacco Plantations, in Java. — BEETS, A. N. J., in *Proefstation voor Vorstenlandsche Tabak, Mededeeling* No. XXVIII, pp. 43-50. Semarang, 1917.

The difficulty of obtaining sufficient quantities of potassium sulphate lead the author to undertake experiments with a view to replacing this fertiliser by potassium silicate and the double sulphate of potassium and magnesium. The first contained 10.9 % of soluble potassium, and the other 22.6 %. The chlorine content was 2.75 %.

The experiments were carried out in soil in which the advantage of potassic manures had been proved by previous tests. A fertiliser composed of sulphate of ammonia, double superphosphate and potassium phosphate gave satisfactory results. The substitution of potassium silicate for potassium sulphate was also satisfactory. Still better results were obtained by the substitution of double sulphate of potassium and magnesium for potassium sulphate. The author points out, however, that the action of the chlorine in this fertiliser may affect the burning qualities of the tobacco.

1026 - Observations on some Direct Bearers, in France. — DEGRULLY, L., in *Le Progrès agricole et viticole*, Year 34, No. 37, pp. 265-269. Montpellier, September 16, 1917.

VINE GROWING.

The years 1915 and 1917 were very disastrous to wine-growing, and for this reason contributed largely to the success, the development and selection of hybrid direct bearers.

The author, wishing to see for himself the results obtained from the hybrids, visited vineyards in different districts of France, and summarises in this paper, his personal ideas and observations.

The high prices commanded by the produce of fine Vinifera plants, allow a large outlay for obtaining them, this outlay often including large expenses incurred in controlling fungous disease.

Thanks to its abundant yield Aramon is almost sure to survive, especially in the fertile plains, where great expense may be risked as there is an almost complete certainty of obtaining, at least every two or three years, a harvest which will compensate for the losses of bad seasons.

Where plants of average yield subject to disease are concerned, a new tendency may be noted. This tendency consists in setting apart in numerous districts, if not everywhere, a fairly large area for direct bearers, so as to have a sort of "insurance against bad seasons". This seems a wise step so long as it is not carried to excess.

No hybrid is *completely immune* to mildew, but many are *practically immune* or easily protected.

A small number of hybrids are described which proved very interesting, especially in 1915 and 1917.



In the south of France, Couderc 71-20 (or 7120) leads by a long way. On an estate at Fréjus (Var), many acres are given up to these vines, now from 5 to 8 years old. Their growth leaves nothing to be desired, and the plants, which are surrounded by vineyards ravaged by mildew, are in excellent condition. When closely examined fairly numerous spots of mildew are found on the leaves, but more of them have fallen, and the harvest is intact and very strong without having had any copper treatment. The sole defect of 7120 is that it ripens rather late, and could hardly be grown outside the Mediterranean basin.

On the same estate Seibel 1020 gave every satisfaction after having been twice sprayed.

In an experimental vineyard near Arles excellent results were obtained with 7120 and other plants, such as Couderc 106-46 (which could be recommended if its wood lignified), Seibel 156 (whose leaves only require 2 or 3 treatments with copper), 1020, etc.

In another experimental vineyard at Cosne (Nièvre), where the soil is stony and contains 49 % of lime, the plants which did best were the following:

Jurie 580, tall plants, fine growth, good harvest; rather late.

Oberlin 595 (Gamay  $\times$  Riparia), tall plants, very early, moderate yield.

Oberlin 605, tall plants, more productive than the preceding one.

Pink Seibel 28-59, early, follows soon after Chasselas.

Couderc mixed hybrid (Couderc 109-88  $\times$  Sauvignon du Cher), seems very good.

In soils containing little lime in this district the following plants do best: Seibel 2003, 1000, 1020, 254 and 2524; Jardin 501 Couderc (tall plants); Oberlin 595 and 605, Jurie 580.

In soils containing a great deal of lime, Oberlin 595 and 605 do best. Next to this experimental vineyard is a Noah vine, which, although many of its leaves are attacked by mildew and a few seeds by brown rot, is *practically immune* and bears a fine harvest.

1027 - **The Improvement of the Native Vines of the United States by Selection and Hybridisation.** — See No. 1015 of this *Review*.

1028 - **The Nettle Tree, Considered from the Points of View of Forestry, Food and Industry.** — DEGLI ATTI M. (Istituto delle Industrie Agrarie e R. Oleificio Sperimentale annessi alla R. Scuola Superiore di Agricoltura in Portici, 1914), in *Annali della Regia Scuola Superiore di Agricoltura in Portici*, 2nd Series, Vol. XIII, pp. 1-27. Portici, 1916.

The nettle-tree (*Celtis australis* L., family Urticaceae) is one of the best trees for replanting forests because of its rapid growth, even in poor and rocky soils. The value of its products (wood, leaves and fruit) soon compensates for the expenses incurred in planting and cultivating it.

In the temperate zone, to which it is best suited, the nettle tree does well in any exposure and in any soil. Its different ways of propagation allow the grower to choose the method of planting which is best adapted to the local conditions and the soil. The tree does well in soils where other trees grow only with difficulty, and helps to cover rocky and arid ground.



When grown on the pollarding system or in groups of coppice shoots, it supplies material for the manufacture of many implements, chiefly agricultural. Each part of the tree is of value and supplies useful material; thus; the wood, by reason of its hardness, fine grain, delicate colour, elasticity and resistance, is excellent for turning or cabinet-making, the leaves are valuable as fodder for animals, especially in seasons and districts in which there is a shortage of green fodder; cattle and goats willingly eat the young leaves which, when fresh, contain 6.30 % of nitrogenous substances, 0.15 % of fat and 19.69 % of carbohydrates.

Nearly every year the nettle-tree gives an abundant crop of stone-fruit very rich in sugar (39.40 % when completely ripe), which makes a very useful foodstuff for live-stock, especially in districts where it is not possible to include sugar in the rations. The kernel contains 67.10 % of fat, that is to say, 7.02 % of that of the whole fruit. When ground the stones yield about 10 % of fat, but, if the kernels are separated from the woody part, this may amount to 60 %. In this case cakes containing about 12 % of protein, 12.4 % of fat and 48.5 of nitrogen-free extract, are obtained. The oil extracted may be used for various purposes.

The nettle-tree should be preferred to all other trees for replanting woods, and offers means of rapidly covering bare ground with plant growth. The speedy and large remuneration promised by its products may serve as an attraction to private land-owners who wish to help in the regeneration of Italian forests.

1029 — ***Pinus canariensis*, a Tree With Wood which does not Rot, Recommended for Replanting Forests in Warm Temperate Countries.** — PEREZ, G. V., in *Bulletin de la Société Nationale d'Acclimatation de France*, Year 64, No. 8, pp. 322-325. Paris, August, 1917.

*Pinus canariensis*, a native of the Canary Islands, is a pine of warm temperate climates whose average annual growth exceeds 1 metre (3.28 feet) in height and 1 cm. (0.39 ins.) in diameter. In 20 years it may attain a height of 20 to 30 metres and a diameter of 20 to 30 cm. (at Teneriffe, a specimen measures 50 metres in height and 2 metres in diameter). It is suited to all soils, from the sea coast to an altitude of 1 500 metres. Its trunk is straight, even when it grows in an isolated position, and its very thick bark prevents fire spreading from one tree to the other.

Its wood, known in the Canary Islands as "Tea" is very hard, very difficult to work, but unequalled for duration and building purposes because it does not rot. When buried it has the resistance of iron.

*Pinus canariensis* has a great future before it in warm temperate climates. For some years large plantations of it have been established in South Africa and have done exceedingly well. Excellent results have also been obtained in Chili. Even as the formerly sterile French Landes are now cultivated, thanks to plantations of maritime pines, so Egypt, Tripoli, Tunis, Algeria and Morocco could find a veritable source of wealth in *Pinus canariensis*.

1030 - **Nursery Practice in the National Forests of the United States.** — TILLOTSON, C. R., in *United States Department of Agriculture Bulletin No. 479, Contribution from the Forest Service, Professional Paper*, 86 pp. 5 fig., XXII plates. Washington, 1917.

Each year about 10 million forest-tree seedlings or transplants are required for the reforestation operations in the National Forests of the United States. The paper analysed gives the rules to be followed in order to keep forest-tree nurseries in a good condition and to produce plants of suitable size and species, of superior quality and ready to be supplied when required. The writer first describes the factors influencing the selection of a nursery site, and passes on to the questions of the size and arrangement of nurseries — outfit — nursery operations — packing and shipping — diseases and injuries — use of fertilisers.

He finally deals with the cost operations and gives the following figures showing some of the actual costs of past nursery operations.

	Cost per thousand	
Growing 1 year stock . . . . .	\$ 0.33 —	\$ 1.50
Care of 2 year stock . . . . .	0.06 —	0.50
Transplanting stock . . . . .	0.77 —	2.04
Care of transplants first year . . . . .	0.18 —	1.03
Digging, packing and shipping of stock . . . . .	0.74 —	2.43

1031 - **The Utilisation of Ash in the United States.** — STERRETT, W. D., in *United States Department of Agriculture, Bulletin No. 523, Contribution from the Forest Service, Professional Paper*, p. 52 + 3 figs. + X plates. Washington, D. C., June 29, 1917.

Ash is one of the leading commercial hardwoods of the United States. Its importance is due to the intrinsic qualities of the wood, for the quantity cut annually, which is from 200 to 300 million feet, amounts to from 2.5 to 3 per cent. of the hardwood lumber output, and to less than 1 per cent. of the total cut of all species.

The bulletin analysed deals with the use of the different species of American ash, and indicates the methods by which owners may utilise their ash timber profitably. It also gives an account of the properties of ash wood.

There are 18 species of ash native to the United States (1), but 98 per cent. of the ash lumber produced is from 3 species: white ash (*Fraxinus americana* L.), black ash (*F. nigra* Marsh), and green ash (*F. pennsylvanica*, var. *lanceolata* Sarg.). The species making up the remaining 2 per cent. are Oregon ash (*F. oregona* Nutt.), blue ash (*F. quadrangulata* Mich.), Biltmore ash (*F. biltmoreana* Beadl.), pumpkin ash (*F. profunda* Bush.), and red ash (*F. pennsylvanica* Marsh). All these species have good cultural possibilities and are considered more important silviculturally than commercially.

Ash is the second most important wood used in aeroplanes. The great bulk of the wood used for this purpose in the United States is spruce, but ash is especially suited for propeller blades, either alone, or in combination

(1) Cf. C. S. SARGENT, *Manual of the Trees of North America*, Cambridge, Mass., U. S. A.

with other woods (1). American ash has supplanted European ash (from the Baltic region) in English shipbuilding (rafters, oars, capstans, bars etc.). Export dealers pay from \$ 30 to \$ 40 per 1000 board ft.

Ash timber is extremely valuable for special uses and a number of articles (handles, butter tubs, vehicles and refrigerators) are made of it. As the supply of standing ash timber is becoming limited, the commercial growing of this tree is necessary to provide for future demands.

## LIVE STOCK AND BREEDING.

1032 - **Studies in Forage Poisoning.** — GRAHAM, R. and HIMMELBERGER, L. R., in *Journal of the American Veterinary Medical Association*, Vol LI, No. 2, pp. 164-187. Ithaca, N. Y., May 1917.

HYGIENE

During the course of experimental studies in connection with a definite outbreak of forage poisoning, wherein an oat hay proved to be quite uniformly poisonous to horses and mules, various types of microorganisms were isolated from the forage. A spore forming, Gram negative, aerobic bacillus, designated in this paper as O-1 and O-1 culture, proved to be pathogenic when administered to horses and mules, less so for cattle, sheep and goats, while guinea pigs, rabbits and white mice were apparently immune. A bacillus possessing characters similar to O-1 designated in this paper as N-1 and N-1 culture, was isolated from a silage in a remote outbreak of forage poisoning among cattle.

It is contributive to the writers' knowledge of this outbreak that sterile filtrates of the bacillus described in this paper, subsequent to daily intravenous injection in some experimental horses, proved pathogenic and capable of exciting clinical manifestations somewhat analogous to those in animals originally affected as the result of feeding on the oat hay, i. e., increased respiration, partial paresis of the pharyngeal muscles and the muscles of the intestinal wall, incoordination, prostration and death. Some literature regarding the etiology of forage poisoning is quoted.

1033 - **Sheep poisoned by Western Golden-Rod (*Solidago spectabilis*), in U. S. A.** — LOCKETT, S., in the *Journal of the American Veterinary Medical Association*, Vol. 51, No. 2, pp. 214-221. Ithaca, N. Y., May, 1917.

It would appear from this brief study that western golden-rod (*Solidago spectabilis*), a forage plant sometimes found in sheep-pastures in the west of the United States, possesses definite nerve-poisoning properties, both in its natural green condition and when cured in hay. The symptoms produced by this plant in sheep which have eaten it may be acute, sub-acute or chronic, according to the amount eaten. Five hundred grammes, eaten in 8 hours, produced, within 23 hours, a severe type of poisoning in a 6 to 7 months lamb. Suitable doses of chloral hydrate seem to be an efficacious antidote. Strychnine sulphate, although not tested by the Author, seems to be suitable for chronic cases.

(1) In Europe, ash wood is also much in request for the same purpose. (Ed.).



- 1034 - *Rhynchosia phaseoloides* and *R. minima*, Plants considered as Poisonous to Live-Stock in the State of Rio de Janeiro, Brazil. — Secretaria da Agricultura, Commercio y Obras Públicas do Estado de São Paulo, Boletim de Agricultura, 18th. Series, No. 6, pp. 451-453. São Paulo, June, 1917.

Communication by the "Director de Agricultura" of the State of São-Paulo.

There are at least 10 species, with different varieties, of the genus *Rhynchosia* in Brazil, and some are considered poisonous to live-stock. This applies particularly to *R. phaseoloides* ("feijão bravo" or "olho de cabra") and *R. minima* ("feijãozinho bravo" or "olho de cabra mendo"). The former is common in the states of the Amazon, Bahia, Ceará, Rio de Janeiro, São Paulo, as well as outside Brazil, in Guiana, Colombia, Central America and the West Indies. The latter is found round the coast of Brazil and at Minas Geraes.

No analysis of these plants has been made.

- 1035 - **Enzootic Paraplegia in Lambs.** — TABUSSO, M. E. (Istituto Nacional de Microbiologia Agrícola Sueros y Vacunas, Lima, Peru), in *La Clinica Veterinaria*, Year XXXX, No. 16, pp. 457-472. Milan, August 31, 1917.

So far as is known at the present day, the disease known in Peru under the empiric name of *renguera* only affects sheep, and specially young ones. It occurs under the form of a mild paraplegia, with symetrical, bilatéral muscular atrophy, usually without loss of sensation.

The causes of the disease are completely unknown. Although it seems to be infectious or contagious (each year it spreads progressively in the districts near the original seats of infection), it is impossible to show the presence of any parasitic agent in the organs or organic products of the animals attacked. Attempts to transmit the disease experimentally have also been unsuccessful. Cold and damp have a favourable influence on the appearance and seriousness of the disease, and it is probably these factors which give it its essentially enzootic character and limit it to certain districts. Young animals certainly have a predisposition to it.

Facts collected up to the present point to the hypothesis that it is a poisoning, of which the greatest affects are localised in certain zones of the neural axis.

Any mineral or alimentary action of the poison must be excluded, for sheepbreeding has been carried on for centuries in the districts now infected and *renguera* is a disease which, till a few years ago, was quite unknown. Until there are proofs to the contrary it seems best to assume the poison to be of a bacterial nature.

The disease cannot be cured therapeutically. Animals which are not seriously attacked do not die if moved to dry surroundings and carefully fed; the disease then becomes chronic with a tendency to recovery. The flesh of animals slaughtered while sick is not harmful.

The only preventative measures possible are the isolation of infected flocks, the immediate slaughtering of the animals attacked, and the changing of pasture and the removal from low, damp districts to high, dry ones.

It is also advisable to shelter the ewes and their lambs in huts during the night, so as to protect them from cold and damp.

*Peruvian renguera* (enzootic paraplegia of lambs) resembles infantile paralysis; it has also many points in common with *Argentine pataleta*.

1036 - **Rinderpest in Swine: Experiments upon its Transmission from Cattle and Carabaos to Swine and Vice Versa.** — BOYNTON, WILLIAM HUTCHINS, in *Philippine Agricultural Review*, No. 9, p. 288. Manila, September 1916: reproduced in: *The Philippine Journal of Science*, Vol. XI, Sect. B., No. 5, pp. 215-265. Bibliographical index referring to 6 publications, 10 diagrams, 2 plates. Manila, September 1916.

Dr. STANTON YOUNGBERG, chief veterinarian of the Bureau of Agriculture of the Philippines, and other veterinarians on rinderpest quarantine work in the field have found that, in localities where rinderpest is present, pigs also develop an ailment practically simultaneously with the appearance of rinderpest in cattle and carabaos (zebus). In one case, in February 1908, on Romblón Island, it was found that an outbreak of rinderpest (a hitherto unknown disease there) among the cattle and carabaos was due to the importation of hogs from Capiz, some 120 kilometers south of the island, and where at the time rinderpest was prevalent.

There is but little literature upon rinderpest in swine, and this little is contradictory (CARRÉ and FRAIMBAULT; FRIEDBERGER and FROHNER; HUTYRA and MAREK; JOBLING).

The writer therefore tried to solve the question by means of experiment. He carried out the following experiments:

Healthy pigs were placed in stalls occupied by cattle suffering from rinderpest (experiments 1 to 10).

Healthy pigs were put into corrals occupied by pigs suffering from rinderpest (experiments 11-13).

Transmission of rinderpest from pig to pig by means of the caretaker (experiment 14).

Inoculation of healthy pigs with virulent blood from pigs suffering from rinderpest (experiments 15 and 16, in which 10 and 2 cc. of blood were used respectively).

Inoculation of healthy pigs with virulent blood from cattle attacked by rinderpest (experiments 17-20 with 6-20-8 cc.)

Inoculation of healthy pigs with virulent blood from cattle and pigs suffering from rinderpest (experiment 21).

Strong injection (50 cc.) of healthy pigs with virulent blood from a carabao suffering from rinderpest (experiment 22).

Healthy cattle were put into corrals occupied by pigs attacked by rinderpest (experiments 23-28).

Inoculation of cattle with blood from pigs suffering from rinderpest (experiments 29-32; amount of blood inoculated from 0.5 to 1000 cc.)

Inoculation of cattle with a mixture of blood from pigs and cattle suffering from rinderpest (experiment 33).

Inoculation of cattle with urine from pigs suffering from rinderpest (experiments 35 and 36).

Carabaos exposed to pigs suffering from rinderpest (experiment 36).



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Inoculation of cattle with urine from pigs suffering from rinderpest (experiments 35 and 36).

Carabaos exposed to pigs suffering from rinderpest (experiment 36).

Inoculation of carabaos with blood of pigs suffering from rinderpest (experiment 37).

Inoculation of pigs with blood of carabaos suffering from rinderpest (experiments 38 and 39).

Transmission of rinderpest from cattle to pigs by means of the caretaker (experiment 40).

Test of immunity of pigs which had recovered from rinderpest (experiment 41, with 10 animals).

Recovery of pigs from rinderpest and their later infection with hog cholera (experiment 42, with 4 animals).

Hyperimmunity of pigs to hog cholera and their subsequent infection with rinderpest (experiments 43-48).

These results suggested to the writer the following conclusions :

1) Pigs can contract rinderpest when exposed to cattle suffering from that disease. The disease thus contracted may terminate in death, unthriftiness or complete recovery.

2) Pigs can contract rinderpest from : exposure to pigs suffering from that disease ; to pigs or cattle contaminated by the caretaker ; inoculation with the blood of pigs or cattle, or a mixture of the blood of pigs and cattle suffering from rinderpest ; inoculation with the blood of carabaos suffering from rinderpest.

3) Cattle can contract rinderpest from : exposure to pigs infected with rinderpest (they, however, do not contract it very readily ; the exact reason for this has not been ascertained) ; inoculation with the blood of infected pigs, or a mixture of the blood of infected cattle or pigs, or with the urine of infected pigs.

4) Carabaos can contract rinderpest from : exposure to pigs suffering from that disease ; inoculation with the blood of infected pigs.

5) Pigs when once they have contracted rinderpest are immune for at least 665 days and no doubt for the rest of their life.

6) Pigs which have recovered from rinderpest may die of hog cholera ; this proves that the first disease does not render the animals immune to the second.

7) Pigs that have been hyperimmunised to hog cholera are susceptible to rinderpest when exposed to cattle suffering from rinderpest. Although the pigs used in the experiments (43 to 48) from which this conclusion is drawn did not suffer so severely from the disease as the average pig, there is a possibility that the strain of virus with which they were infected was not of the most virulent type. This condition is frequently noted in rinderpest in cattle : one strain may cause a high mortality, while another may cause a comparatively low mortality. Thus, it is rather difficult to state definitely that hyperimmunisation to hog cholera was of any benefit to the pigs when they were exposed to rinderpest.

8) In summing up the results of these experiments, it will be noted that cattle, carabaos and pigs vary but slightly in susceptibility to rinderpest and that the disease can be transmitted practically as readily from one kind of animal to the other, as among individuals of a single species.

1037 -- **The Virulence of Hog-Cholera Blood at Different Periods During the Disease.**

— WHITING, R. A., in *Journal of the American Veterinary Medical Association*, Vol. LI, No. 4, pp. 477-493. Ithaca, New York, July 1917.

In the production of hog-cholera blood for serum purposes the selection of the opportune time for killing the animals inoculated with virus is very important both from the technical and the economic standpoints. The writer carried out the experiments described in the paper analysed in order to determine the virulence of hog-cholera blood at different periods of the acute type of the disease. He found that there is a gradual increase in the virulence of the blood as the disease progresses from 4 to 8 days following inoculation, and that the 8 day blood was the most virulent.

Thus in producing the serum one may be justified in killing inoculated hogs, beginning 6 days after inoculation, provided there is a corresponding high temperature and a manifestation of symptoms, especially weakness.

1038 -- **Some Aspects of the Physiology of Mammary Secretion (1).** — HILL, REUBEN

L. (Maryland Agr. Exp. Sta.), in *Journal of the American Veterinary Medical Association*, Vol. LI, No. 5, pp. 642-651. Ithaca, N. Y., August 1917.

ANATOMY  
AND  
PHYSIOLOGY

The object of these investigations on goats was to continue the study of the effect of pituitary extract injection on the quality and quantity of milk secreted, its mode of action and the effect of its repeated injection upon the animal.

The conclusions reached were the following :

The injection of pituitary extract into lactating animals produces an immediate secretion of milk even though the mammary gland had been hand milked just preceding the injection.

The milk secreted as a result of pituitary injections has a super-normal fat content but the amount of milk and usually, but not invariably, the fat it contains is decreased at the next milking period. The total daily secretion of milk is only slightly altered by the injection of pituitary extract ; there may be either a slight gain or a loss in the total amount secreted.

The mammary gland of a goat does not respond to more than two injections of pituitrine given at two hour intervals.

If the injections of pituitary extract are continued for a sufficiently long period a temporary tolerance for its action on the mammary glands may be established. This tolerance may entirely disappear by the next lactation period. Similar results have been obtained by the injection of pituitary extract into lactating cats, dogs, goats, cows and the human subject both as to the quantity and quality of the milk secreted and the rapidity of the response to the injection.

There seems to be good evidence in support of both the glandular and muscular theories of the action of pituitary extract on milk secretion. The results of these researches would, however, seem to lend themselves more to the support of the former theory.

(1) See also R., August 1917, No. 738

(Ed.)



FEEDS  
AND FEEDING

1039 - **Utilisation of Farm Wastes in Feeding Live-Stock in the United States.** —

RAY S. H., in *United States Department of Agriculture, Farmers' Bulletin* No. 873. Washington, D. C., August 1917.

The unprecedented demand for grain for human consumption makes it imperative that only those feeds be used for live stock which are not needed for human food.

More than one-third of the total production of grain straw in the United States is not being used to advantage and, of this amount, one half is an absolute loss. Of the 245 million tons of corn stover produced annually in the United States it is estimated that only 81.5 % is fed to stock and that at least 35 % of this amount is lost through wasteful methods of feeding.

During the past years large quantities of cottonseed meal have been used for direct fertilizing, six of the Southeastern States having used in 1914 nearly 1 million tons for such purposes. This meal is worth from \$ 30 to \$ 40 a ton for feeding cattle, and about 25 % of its fertilizing value is lost when it is so used.

This bulletin indicates methods whereby these wastes may be eliminated, the herds and flocks economically maintained, and the amount of grain used for the feeding of live stock reduced to the minimum.

1040 - **The Use of the Leaves and Fruit of the Nettle-Tree for Feeding Live-Stock.**

— See No. 1028 of this *Review*.

BREEDING

1041 - **Selecting Dairy Bulls by Performance.** — CARROLL, W. E., in *Utah Agricultural College, Experiment Station Bulletin* 153, pp. 1-20. Logan, Utah, April 1917.

Selecting dairy bulls by performance is fast coming to be recognized as the only reliable method. By performance in this sense is meant the ability of the bull to endow his daughters with powers of high milk production.

The data reported in this bulletin are taken from Volume 26 of the *Holstein-Friesian Year-Book* (U. S. A.), containing all entries to June 1, 1915. Seven-day records were considered because of an insufficient number of yearly records to be of value in a statistical study of this kind.

Only bulls having fifty or more daughters registered in the official "Advanced Register" are considered. The list contains 32 bulls, including most of the very famous Holstein bulls. These 32 bulls have to their credit a total of 2 579 tested daughters and 1 052 proven sons, who in turn have 7 632 tested daughters. The calculations include, therefore, 2579 records in one group and 7632 in another, or a total of 10 211 individual butter-fat records.

The study is, therefore, of necessity of a selected population. Untested daughters are manifestly not included and only the tested daughters are considered that have produced at least the minimum butter-fat requirements set by the association, other records not being entered in the *Advanced Registry Books*.

The following tabulation of these 10 211 records classified according

to age of cow indicates that the present association age requirements do not really represent the average productive capacities of cows of the respective ages.

*Average Fat Produced and Average Percentage Value  
of 10 211 Cows by Ages.*

Age	Years	Daughters of 32 bulls			Sons of 32 bulls			Total			Standards	
		No. of cows	Average lbs. fat	Percentage Value	No. of cows	Average lbs. fat	Percentage Value	No. of cows	Average lbs. fat	Percentage Value	Present	Revised
Junior .	2	490	11.7	162.5	2 266	11.4	158.3	2 756	11.5	159.7	7.2	7.7
Senior .	2	257	13.0	162.5	954	12.7	158.7	1 211	12.8	160.0	8.0	8.6
Junior .	3	242	14.6	165.9	962	14.5	164.8	1 204	14.5	164.8	8.8	9.8
Senior .	3	251	16.1	167.7	786	15.2	158.3	1 037	15.5	161.5	9.6	10.4
Junior .	4	253	17.0	163.5	652	16.5	158.7	905	16.6	159.6	10.4	11.2
Senior .	4	209	18.1	161.6	493	16.6	148.2	702	17.0	151.8	11.2	11.5
Aged .	—	877	18.4	153.3	1 519	17.5	145.8	2 396	17.8	148.3	12.0	12.0

If the age requirements of the Association were in accordance with the relative productive capacity of each class, the average percentage values of all would be approximately the same. As it is, however, the cows of one group (aged) produced on the average only 48.3 % more than the Association requirement for that age, while the cows of another group (Junior three year old) exceeded the requirement by 64.8 %. It is easier for the junior three-year-old cows to attain to the Advanced Register than it is for the others. The senior three-year-olds stand next, while the aged cows stand last.

The last two columns in Table I show clearly the differences between the present association age requirements and the actual average productive capacities of cows of the different ages as shown by the 10 211 records included in this study.

*Treatment of the Data.* Under each bull's name were listed the records, reduced to a percentage basis, of all of this daughters. For example, a junior two-year-old daughter of a certain bull has a seven-day record of 10.8 pounds of fat. This is 150 % of the Association requirements for a heifer in this class (7.2). The value of her record was therefore listed as 150 %. This process was continued for the record of each daughter. Conversion to these percentage values eliminated age, thus placing all records on a comparable basis. The averages of these values for the daughters of each bull can be considered the comparative values of the bulls, as revealed by the performance of their A. R. O. daughters.

From the tables presented it appears that the number of A. R. O. daughters a bull has cannot be taken as a true index of his value as a breeder — this may indicate only his opportunity. Neither can his real



value be measured by a few high — producing daughters. High average production in all of his daughters is the final measure of a good bull.

The list of the thirty-two bulls arranged in descending order in the average percentage value of their daughters is headed by King of the Pontiacs 702-39 037 (149-76-30) a ten-year-old bull having 149 A. R. O. daughters with an average percentage value of 186.4. King Segis stands second with a value of 181.2. Lord Netherland De Kol has been heralded by some as the great bull of the breed, because until 1915 he had the greatest number of A. R. O. daughters. He was surpassed in this regard in 1915 by King of the Pontiacs. When judged by the performance of all his A. R. O. daughters, Lord Netherland De Kol stands lowest in this list of thirty-two bulls with an average of 133.9. The tabulations also show that the coefficient of correlation of the average value of the daughters of the thirty two bulls examined and the value of the daughters of the sons of the same bulls is higher than might be expected ( $0.6326 \pm 0.0715$ ). This, however, is not considered evidence that milk production is transmitted through the male line. The writer regards it merely as greater intensity of breeding on the part of the bulls, due to the more rigid selection for milk production which they have undergone.

1042 — **Stock-Breeding in Switzerland during the War.** — KÄPPELI, DR., in *Annuaire agricole de la Suisse*, Year XVIII, Pt. I, pp. 15-26. Berne, 1917.

The last livestock census taken in Switzerland, on the 19th. April, 1916, gave the following results.

	1916	Increase (+) or decrease (—) on the 1911 census
Cattle, total . . . . .	1 615 645	+ 172 162
Cows . . . . .	848 652	+ 51 743
Horses, total . . . . .	136 613	— 7 515
Brood-mares . . . . .	10 055	+ 3 631
Pigs, total . . . . .	544 021	— 26 205
Sows . . . . .	54 424	— 1 481
Goats . . . . .	358 093	+ 16 797
Sheep . . . . .	171 635	+ 10 221

The increase in cattle is very marked. Already before the war, when the price of milk was falling, the breeding of young cattle had increased. As a precautionary measure, the Federal Council, by the decree of the 8th. August, 1914, forbade the slaughtering of calves under 6 weeks old. The aim of this measure was to prevent a depreciation in the value of fat calves and milk, and to encourage the breeding of young cattle. Later, the regulations concerning the slaughtering of calves were modified, then, last autumn, suspended, in order to increase the quantity of milk available for human consumption.

The increase in horse-breeding is comprehensible in view of the fact that, since the 1st. August, 1914, importation has practically ceased. Attempt should be made to produce a medium weight draught-horse, strong-legged and speedy; these qualities are all found in the improved Franche-Montagnes horse.



Poultry rearing is fighting against great difficulties. Not only is the grain required for feeding the poultry very dear, but it is also very scarce. By a decree of the 30th. January, 1917, the Federal Council authorised the feeding of native grain to poultry.

The organisation created for the exportation of cattle will play a great part, after the war, and will continue to be of great value to Swiss stock-breeding. There is also no doubt that the milk producers' societies and organisations will henceforth have a great influence on the dairy industry, to the advantage not only of the producers, but also of the population and country.

1043 - Silage for Beef Production. — STARR, CH. G. (Purdue University), in *The Breeder's Gazette*, Vol. LXXII, No. 11, p. 374. Chicago, September 13, 1917.

The problem of reducing the cost of feeding either by using cheap feeds, or securing more feed per acre, or both, must be faced to day by cattlemen in order to remain in the cattle feeding business. In fact, with corn at \$1.25, \$1.50 and \$1.75 per bushel many cattlemen have given up business.

Until the advent of the silo the best dry-lot ration was probably the one made of maize, cottonseed meal and clover hay.

For eight years maize silage has been introduced into the clover hay ration by the Indiana Experiment Station at Purdue University.

The following table gives the average feed required to produce a pound of beef, showing the value of silage as roughage with clover hay during the winters from 1909 to 1917 with 160 cattle.

Feed	Feed per pound of gain	
	Lots without silage	Lots with silage
Maize. . . . .	7.30 pounds	5.57 pounds
Cottonseed meal . . . . .	1.18 "	1.19 "
Clover hay. . . . .	4.93 "	1.34 "
Maize silage . . . . .	— "	11.65 "
Daily gain. . . . .	2.42 "	2.38 "

The average prices received for the clover hay lots and the silage lots have been approximately the same, varying slightly from year to year. For every 100 pounds of beef put on by the steers 1165 pounds of corn silage replaced 146 pounds of shelled corn and 359 pounds of clover hay. Taking the price of clover hay at \$15 per ton, the following table has been compiled from the replacement of corn and hay by silage to show the worth of corn silage in fattening cattle when corn varies in price :

When maize is worth	A ton of silage is worth
56 cents per bushel	\$ 7.12 per ton
90 cents per bushel	\$ 8.64 per ton
\$ 1.00 per bushel	9.22 per ton
\$ 1.25 per bushel	10.21 per ton
\$ 1.50 per bushel	11.30 per ton
\$ 1.75 per bushel	12.50 per ton

To answer the question as to whether all the clover hay could be replaced by corn silage, 80 cattle were fed, from 1909 to 1913, with the following ration :

Feed	Feed per pound of gain	
	Silage alone	Silage and clover hay
Maize . . . . .	5.97 pounds	5.67 pounds
Cottonseed meal . . . . .	1.14 »	1.12 »
Silage . . . . .	12.65 »	11.16 »
Clover hay . . . . .	— »	1.14 »
Daily gain . . . . .	2.37 »	2.45 »

About a third of a lb. more of shelled corn was needed by the silage-alone cattle for each lb. of gain in addition to the extra silage consumed. The gains were in favour of the lots receiving clover hay in addition to silage.

To settle the question as to whether some cheap roughage such as oat straw could be substituted for the clover hay a series of lots from 1911 to 1914 was fed on oat straw instead of clover hay. The following table shows the results with 60 cattle :

Feed	Feed per pound of gain	
	Oat straw lots	Clover hay lots
Maize . . . . .	5.60 pounds	5.66 pounds
Cottonseed meal . . . . .	1.14 »	1.15 »
Straw or hay . . . . .	0.56 »	1.08 »
Silage . . . . .	10.58 »	10.37 »
Average daily gain . . . . .	2.45 »	2.40 »

It appears that oat straw is as good as clover hay in giving fattening cattle a little dry filler in a ration of shelled maize, cottonseed meal and maize silage. The cattle eating rations containing liberal amounts of maize silage will only consume a small quantity of dry roughage. Oat straw seems to satisfy them. The finish carried by the cattle in these lots was practically the same.

When it is considered that a 50 bushel crop of corn will produce 10 tons of silage in the silo, the cattle feeder may materially reduce the cost of his feed till over that of even such a good ration as maize, cottonseed meal and clover hay and at the same time he will produce more available cattle feed per acre of his farm. The cattleman using silage can eliminate his non-silage neighbour through economy of production, as he is feeding at less cost.

1044—The Improvement of "Caracú" Cattle in the State of Sao-Paulo Brazil (1). —

DE CAMPOS PENTEADO MARCILLO, in *O Criador Paulista*, Year XII, No. 7, pp. 155-174 + 22 figs. Sao-Paulo, July, 1917.

A breed may be improved by two methods — crossing and selection. In Brazil, where the "Caracú" breed is concerned, there are many obstac-

les to the first method: 1) lack of resistance of European improving stock to piropilasmosis or "tristeza"; 2) the danger of introducing tuberculosis into Brazil with European animals; 3) lack of adaptation of the European breeds to the environment (climate and pasture) of Brazil. This explains the many disasters with which the introduction of foreign bulls, begun in the State of São-Paulo in 1897, has met. Since that date, up to 1916, out of 979 improving bulls imported from the Argentine, Uruguay and Europe for the "Posto Zootecnico Central Dr. Carlos Botelho" and other institutes, 543, or 55 %, died of piropilasmosis. This percentage is believed to be still higher for stock imported for private breeders. As the cross-breeds have the same characters as the improving breed, they must have the same food as the latter have in their native land; but the Brazilian pasture-lands are composed essentially of Gramineae and rarely contain Leguminosae, while lucerne fields do not exist in the country. On the other hand, crossing, repeated periodically, by which this difficulty might be overcome, is not in the power of the ordinary breeder, who has not sufficient knowledge to apply this method scientifically. Crossing, therefore, is only to be recommended in exceptional cases, for dairy or beef stock, but never for breeding stock.

The best breed for selection in the State of São-Paulo is the "Caracú" breed. This is proved conclusively by the excellent results obtained with it at the "Posto Zootecnico" of Nova Odessa.

Table I compares the coefficients of growth (I) given by MR. VILLEBRESME (*L'élevage en Europe et en Amérique*) with those obtained by the above-mentioned Institute for the "Caracú" breed. It will be seen that the "Caracú" breed surpasses the early maturing breeds in this respect.

TABLE I. — *Coefficients of growth of the "Caracú" breed compared with those of early maturing breeds.*

Early maturing Cattle			"Caracú"		
Age	Live weight	Coefficient of growth	Age	Live weight	Coefficient of growth
1 year	300 kg	22.5	1 year	298.8 kg	22.4
2 years	480	18.7	2 years	521	20.4
42 months	650	14.7	36 months	745	19.8

Of the cows, only certain cross-breeds of the 1st. generation with the best breeds (Dutch, Schwytz, Simmenthal, Red Polled, Devon, Hereford) have a greater coefficient of growth than the Nova Odessa "Caracú" cows. This shows that, by improving the breeding methods, the selection of a superior breed would proceed with great rapidity.

The "Caracú" breed may be selected for beef as well as for milk and draught.

(I) The coefficient of growth (or development) is determined by dividing the weight of the animal minus its average weight at birth (30 kg.) by the number of months of its life.

(Ed.).



With regard to beef cattle, animals bred in the open frequently attain 1760 lbs. of live weight. At the São-Paulo exhibition of May 1917, there was an animal which, without having been subjected to any special intensive feeding, weighed 2090 lbs. The frame is fairly small. Table II gives the results of experiments on the yield at slaughtering made in May, 1917, at the Osasco frozen-meat lairage of the Continental Product Company, with ordinary "Caracú" cattle bought on the market.

TABLE II. — Yield of "Caracú" cattle at slaughtering.

	3 young oxen	3 adult oxen
Live weight . . . . .	3 355 lbs.	5 302 lbs.
Net weight of meat . . . . .	1 881	3 196.6
Percentage of meat . . . . .	56.06 %	60.29 %
Weight of the fresh skin . . . . .	275 lbs. = 8 %	412.4 lbs. = 8 %

Under ordinary conditions of breeding, the lactation period of the "Caracú" cow is very short, but the Nova Odessa results prove that it is sufficient to pay careful attention to its food and, above all, to milk it regularly, in order to turn it into a good dairy cow. Five cows, during their first period of lactation, which lasted 12, 10, 10, 11 and 10 months respectively, gave 5 669.62, 3 584.46, 3 016.86, 2 893.44 and 2 864.18 lbs. of milk. This milk has a high fat content, 1.6 to 1.7 galls. being required to obtain 1 lb. of butter.

The improved European cows which were imported into Brazil suffered a great reduction in the percentage of calves produced. The report presented in 1915 to the Minister of Agriculture of the State of São-Paulo by the Inspector of zootechny who investigated the results of the introduction of foreign cattle into the state includes the following calving percentages for "Caracú" × European dairy breed cross-breeds; the figures were collected from 18 farms: Dutch cross-breeds, 65-70 %; Schwytz cross-breeds, 70-73 %; Simmenthal cross-breeds, 50-60 %; Red Polled cross-breeds, 75-80 %; Devon cross-breeds, 70-74 %; Hereford cross-breeds, 75-80 %. All these averages are greatly exceeded by those obtained at Odessa for the pure "Caracú" breed, which are 89 to 95 %. The cows are usually put to the bull at 21 months, but some are quite ready at 11 months. The bulls are used for service when from 16 to 18 months old; some could be used at 11 months.

In order to encourage the improvement of the race, a "Caracú Herd Book" has been started in the State of São-Paulo; in July, 1917, 1 059 cows and 78 bulls were entered in it. It is composed of two herd-books, one temporary, the other permanent. In the first are entered breeding stock and their offspring approved and marked by an official Commission; these, when adult, are subjected to a closer examination and, if approved, entered in the permanent herd-book.

The paper contains about twenty portraits of fine specimens of the "Caracú" breed, of which the bull "Mozart" is a particularly excellent example.

1045 - The Outlook for Farm Sheep Raising in the United States. — MARSHALL, F. R. and MILLIN, R. B., in *Farmers' Bulletin* No. 840 of the United States Department of Agriculture, pp. 1-24. Washington D.C., July 1917.

SHEEP

An important change in the extent and character of the American farm sheep industry began in 1915. Higher prices for lambs and wool in that year and the years following attracted wide attention to this branch of animal husbandry.

The higher prices of sheep products after 1914 were caused in part, but not mainly, by market conditions resulting from the war. The supply of lamb and mutton had been decreasing for some time in spite of the growing demand, particularly for lambs. Wool values were advancing before the outbreak of the war. Although the world consumption of wool was increasing, no foreign country, with the exception of South Africa, seemed able to increase its exports. Increased supplies of wool in the future must come chiefly from farm flocks.

In the United States, conditions for farm sheep raising are more favourable than in any country which has not already developed to the point at which sheep are necessary for intensive farming.

*Sectional Prospects for Sheep production.* — In the Eastern States the large and numerous flocks of earlier years were kept almost entirely for wool production. Subsequently the increasing wool supplies from other sections and from abroad, together with the demand for other agricultural products of higher value, brought about a decline in the number of farm sheep in these States. The cheaply produced western supplies were for some time equal to all requirements. To day the western shipments have not only ceased to increase, but have actually grown less as a result of the reduction of the range area.

In New England the sheep raising of the present is planned to market lambs at from 4 to 5 months of age, and wool, though important, is not the primary consideration. The full and economical utilization of New England farm labour, pastures, hay and silage calls for more and larger flocks to supply the near-by markets. The present production can probably be multiplied three times without materially lessening other live-stock production.

Throughout the entire length of the Appalachian Mountain Range in Pennsylvania, Maryland, Virginia, West Virginia, Kentucky, Tennessee and North Carolina, there are large areas of land of comparatively low value and well suited for sheep raising.

In the hillier sections of northern Arkansas and southern Missouri and in the cut-over timber region of the Gulf States there are also large areas of comparatively cheap lands which furnish favourable conditions for the keeping of large flocks of sheep at comparatively low cost. Similar opportunities are found in the cut-over timber lands in Michigan, Wisconsin, Washington and Oregon.

On the higher priced lands of the corn belt a profitable system of sheep raising is being worked out along the lines followed on the intensively farmed areas in England and Scotland. While land values in this section



are much higher on the acre basis than in the regions referred to above, there is comparatively little difference in the value of the amount of land required per head for sheep. While few farms in this section are likely to be devoted exclusively to commercial sheep raising, the different labour requirements for cattle and swine make it possible to keep at least 1 ewe to 2 acres. This should add materially to the net income from the farm.

On western irrigated farms there seems likely to be developed an intensive sheep industry. The alfalfa and other forages produced on these lands come nearer to being satisfactory as a sole ration for sheep than for any other stock. The use of irrigated pastures based on the rotation of forages will provide excellent summer feed and at the same time avoid the cost of labour for harvesting where there is not an opportunity of using the open range or forest reserve for grazing at that time of year.

This bulletin contains important suggestions for beginners in farm sheep raising and management.

## PIGS

1046 - **The Model Garbage-Disposal Piggery belonging to Worcester, Massachusetts, U. S. A.** — BONNET, FREDERIC, JR., in *Engineering News-Record*, Vol. 79, No. 9, pp. 396-400, 8 figs. New-York, August, 30, 1917.

Worcester is a town of about 175 000 inhabitants in which about 70 % of the garbage is fed to pigs.

The town has a home farm of 376 acres and, in addition, leases another of 220 acres. On these farms are kept 2 000 to 3 000 pigs. Pig-breeding as a means of utilising the town refuse has been carried out since 1872.

To facilitate the collection of the garbage the town is divided into 21 sections. There is a special collection for the fish offal and rotten eggs from markets and commission houses. This material, which is not fed to the pigs, is buried.

Each collector collects one load, which he deposits at the farm. He also has to unload and clean his wagon and attend to his horses. There is, however, a special employee for feeding the horses. The teams leave the farm at 7 a. m. and have an average daily haul of 13 miles. It takes from 2 to 4 hours to collect a load, the average time per house collection being 1.65 minutes. The Board of Health requires that the garbage be placed in water tight, covered receptacles, and that no tin cans, water, ashes, glass, shells, etc. be placed in the receptacles. An average of 20 tons of refuse is collected per day. The use of municipal garbage has never caused any disease amongst the pigs, and garbage-fed hogs command the same price as hogs fed by the ordinary methods.

The pigs eat the garbage as it is brought to the farm ; it is neither washed nor steamed. Young pigs are kept with the sow till they are 6 weeks old, and are kept in pens till they are 6 months old, when they weigh about 75 to 100 lbs. They are then turned into hog-lots (100 pigs to about 3 acres). The refuse is fed to the pigs on feeding platforms. When the soil around the platforms becomes fouled, the platforms are moved and the ground ploughed up. This system prevents the formation of any bad smells. The



platforms are cleaned every day, and the material removed composted or buried.

When 5 to 6 weeks old the pigs are inoculated (double-treatment method, virus and serum) against cholera. The total cost of treatment, a 20 cc. injection, which has proved very efficacious, is 70 cents. per pig exclusive of the necessary help. In 1915 the herd was attacked by an epidemic of foot-and-mouth disease; 2 360 animals were killed, the cost being borne partly by the Federal Government and partly by the State. The sows are bred by turning about 300 of them into the same lot with about 30 boars for about 5 weeks. The first lot are bred from about October 20th. till December 1st. Farrowing thus begins at the end of January and continues till early March. After a month or six weeks a second lot of sows are bred, and so on. The pigs are kept for about 15 months, when they weigh 250 to 300 lbs. The last lot sold (May, 1917) realised 16.35 cents. per lb. live weight, or 21 cents per lb. dressed weight.

The herd is kept in 12 pig-sties scattered about the farm. Details of the piggeries, of which the most recent cost \$ 3 000 each, are given. In addition, there are 100 small portable take-down pens for late spring farrowing.

Details are also given of the cost of garbage collection and of the upkeep of the pigs, which at present amounts to about \$ 60 000. The expenditure generally exceeds the receipts, but, nevertheless, feeding garbage to hogs is considered the most economical and satisfactory method of disposal, and it has been proved that, if it be done in a sanitary and intelligent manner, there is an absence of any appreciable smell.

1047 - **Protein Feeds for Laying Hens** (1). — KEMPSTER, H. I., in *University of Missouri College of Agriculture, Agricultural Experiment Station Circular* 82, pp. 1-12. Columbia, Missouri, June 1917.

POULTRY

*Tests to determine the value of beef scrap and sour milk.* Feeding tests conducted at the Missouri Agricultural Experiment Station have shown that sour milk or beef scrap added to the poultry ration materially increases egg production. These tests extended from November 1, 1914 to October 31, 1915 and from November 1, 1915 to October 31, 1916. Results of these tests together with results from feeding protein concentrates of vegetable origin are presented in this bulletin.

From the tests it appears that the addition of protein concentrates of vegetable origin, such as oil meal, glutenmeal and cottonseed meal, to a ration has but little influence on egg production. Where sour milk, or beef scrap was used the production was very nearly double and while the cost of the ration was increased from 9 to 13 cents per hen per year the extra profit paid for this ten fold. The oil meal mash was not consumed in as large quantities as the other mashes, indicating that the hens did not relish this as much as they did the other mashes.

(1) See also R. Sept. 1917, No. 837. (Ed.)

The following table shows how protein feeds affected egg production:

*Basal ration of grain and mash plus various proteins.*

Protein feeds	Eggs produced
Sour Milk	129 per hen per year
Beef Scrap	120 per hen per year
Cottonseed Meal	66 per hen per year
Linseed Oil Meal	64 per hen per year
Gluten Meal	63 per hen per year
No Protein Feed	57 per hen per year

In each case the protein feed constituted approximately one-twelfth, the mash (bran 1, corn meal 1, shorts 1) three-twelfths, and the grain (corn 2, wheat 1) eight-twelfths, of the ration by weight.

With the cost of feed based on the quotations of a local mill at the following rates: wheat at \$1.66 per 100 pounds; corn at \$1.60 per 100 pounds; bran at \$1.20 per 100 pounds; corn meal at \$1.70 per 100 pounds; shorts at \$1.40 per 100 pounds; beef scrap at \$3.25 per 100 pounds; sour milk \$0.20 per 100 pounds; the average cost of food per hen per year was \$1.026-1.13 for the beef scrap ration; \$1.05 - 1.14 for the sour milk ration; and \$0.956 - 1.00 for the ration without beef scrap or sour milk. The average per hen per year of beef scrap supplied was 4.2 - 5 pounds; and of sour milk 88-83.8 pounds. The total food cost of a dozen eggs produced was \$0.122-0.106 for the beef scrap ration; \$0.10 - 0.112 for the sour milk ration; and \$0.222-0.21 for the ration without meat or milk, on account of the different amount of eggs obtained with the different rations.

1048 - **The Feed Cost of Egg Production; Experiments in U. S. A.** — LAMON, H. M. and LEE, A. R., in *United States Department of Agriculture, Bulletin No. 561*, pp. 42. Washington, D C., August 18, 1917.

Results of 3 years' experiments at the Government Poultry Farm. During the third year, sixteen pens, containing 366 fowls, were used for the experiment.

The average egg yield for the first laying year in all pens was 131 eggs and the highest pen average yield was 169.5 eggs. In the second year the average egg yield of all pens was 92.7 eggs, which decreased to 78.2 eggs in the third laying year.

Eggs were produced at an average cost for feed only of 10 cents a dozen during the pullet year, of 14 cents in the second year, and 19 cents in the third year. Prices of individual grains in 1917 are from 20 to 100 per cent. higher, which should be carefully considered in estimating the present cost of egg production.

The average value of eggs over feed cost the first laying year was \$2.56 per hen, falling to \$1.41 the second year, and to \$0.79 the third year. The highest average value in any pen was \$3.41.

The general-purpose fowls consumed annually 72 pounds of feed which cost \$1.13, while the Leghorns ate 55 pounds, which cost 87 cents.



Good results were obtained with rations both with and without oats. The use of this grain added variety to the ration without increasing the cost. Fowls not fed any beef-scrap or other animal protein laid only 90 eggs during their pullet year compared with 137 eggs from the beef-scrap pens, and 84 compared with 83 in their second year. The eggs of the no-beef-scrap pens cost about 2.2 cents per dozen more to produce the first laying year, but these costs were about equal during the second year. The fowls not fed beef-scrap laid very poorly in winter, thus materially reducing the value of their eggs.

Cottonseed meal used in place of beef scrap as a high-protein feed in the ration produced brown or greenish spots on the yolks of the eggs, especially in warm weather, making a considerable proportion of them unfit for market. Eggs were produced more cheaply and at a considerably greater profit on the beef-scrap ration.

Fish meal at \$ 7 a ton less than beef-scrap proved to be a good high-protein feed, which can be used to advantage to replace beef-scrap. The fish meal did not in any way affect the flavour or quality of the eggs.

General-purpose fowls allowed to select their own mash constituents ate a dry mash containing about 63 per cent. cornmeal, 19 per cent. beef scrap, 9 per cent. bran, and 9 per cent. middlings. Leghorns ate a mash of about 66 per cent. cornmeal, 26 per cent. beef-scrap, and 4 per cent. each of bran and middlings. No better results were obtained by this method of feeding than where the ground grains were mixed together in a mash.

Good mashes, as indicated by these experiments, may be made of 66 per cent. cornmeal, 26 per cent. beef-scrap, and 4 per cent. each of bran and middlings, or 2 pounds of cornmeal and 1 pound each of bran, middlings, and beef-scrap, with a scratch feed in each ration of equal parts by weight of cracked corn, wheat, and oats, which is fed so that the hens receive about equal parts of scratch feed and of mash.

The Leghorns on free range gave a considerably greater egg yield than those confined to a fair-sized yard. This difference was less marked in the general-purpose hens.

Sprouted oats fed as green feed to hens confined to yards cost about 10 cents per hen a year and 1 cent per dozen eggs, not including any charges for labour and equipment. The hens ate on an average in one year about 1.3 pounds of oyster shell and 0.7 of a pound of grit, which together cost about 1 cent per hen.

The Leghorns did not lay as well in the winter as the general-purpose breeds, especially during their second year, but the Leghorns produce eggs about 3 cents per dozen cheaper during their first year, 6.4 cents cheaper in their second year, and 9.8 cents cheaper in their third year than the general-purpose breeds. One pen of Leghorn pullets produced eggs in their first year at a feed cost of 6.7 cents per dozen, while the value of the eggs per hen for the year was \$ 3.41 over cost of feed.

The average weight of a dozen eggs from the general-purpose fowls during their pullet year was 1.53 pounds, 1.60 during their second year, and 1.63 during their third laying year. The eggs from the Leghorns aver-



age 1.45 pounds during their pullet year, and 1.49 during their second and third years.

The egg production of the general-purpose fowls decreased 32 per cent. in their second laying year. The decrease was considerably less in the Leghorns, their 2-year average egg production exceeding that of the general-purpose breeds by 19 eggs. The decrease in production from the second to the third year was only 4 per cent. with the Leghorns, compared with 13 per cent. in the general-purpose breeds.

The cheapest eggs are produced in the spring, during April, May and June, while the greatest costs occur in October, November, and December. The lowest monthly feed cost of a dozen eggs in any of these experiments was 4 cents, while in some cases no eggs at all were produced during the month.

1049 - **Turkey Raising in Texas, U. S. A.** — See No. 1081 of this Review.

## SERICULTURE

1050 - **The Biology of the Larvae and Moths of *Bombyx mori* of Parthenogenetic Origin.** — LÉCAILLON, A., in *Comptes Rendus de l'Académie des Sciences*, Vol. 165, No. 8, pp. 289-291. Paris, August 20, 1917.

In a recent paper (1) the Author reported that he had successfully obtained and reared 4 larvae from eggs laid by a female of *Bombyx mori* which had been prevented from mating. The results of his observations on breeding out these larvae, their sex, reproduction and progeny, were as follows:

1) The 4 larvae fed easily on leaves of white, black or red malberry. Their growth was rather slower (an average of 45 days) than that of normal larvae. When they spun their cocoons, 3 of the larvae were of the same size as normal larvae, the 4th. was much smaller (only 2 grammes).

2) The duration of the pupal stage was also a little longer than the normal (16 to 17 days).

3) Of the 4 moths, 3 were males and 1 female. One of the males was extremely small and could not mate; the other 3 moths showed no outward difference from those of normal origin, and mated in the usual way.

4) The breeding of the two males and the female was studied as follows:

When the first male was put with an ordinary female, copulation immediately took place and was of normal duration. The fertilised female laid about 300 eggs of which one only remained pale yellow, i. e., escaped fertilisation, whereas the others underwent normal change of colour. After the first oviposition, copulation again took place, followed by a second oviposition of 56 eggs, of which only 4 were unfertilised.

The second male behaved in a similar way to the first. The female with which it was mated laid about 250 eggs, of which 10 were unfertilised.

The female of parthenogenetic origin when isolated laid first 45 eggs, then 63 more. Mated with an ordinary male it laid 195 more eggs. Only

(1) See R., October 1917, No. 936.

(Ed.).

one of the eggs laid before mating underwent change of colour. The eggs laid after mating, with the exception of 6, changed colour normally.

**Conclusions.** — The two sexes are present among larvae of *Bombyx mori* produced by parthenogenesis. The evolution of the larvae, chrysalides and moths of parthenogenetic origin differs but little from that of individuals of normal origin. Well-constituted individuals of parthenogenetic origin breed in exactly the same manner as normal individuals. The capacity for parthenogenetic reproduction does not appear to be more marked in females of parthenogenetic origin than in those from fertilised eggs.

## FARM ENGINEERING.

1051 - **Trials of Agricultural Tractors at Noisy-le-Grand, France, in 1917.** — RINGELMANN, MAX, in *Feuille d'Informations du Ministère de l'Agriculture*, Year 22, No. 31, pp. 3-6. Paris, July 31, 1917.

Twenty-seven machines took part in the trials at Noisy-le-Grand, 7 being of French, 1 of Italian, and 15 of American construction.

The published report only deals with 9 tractors; the writer will shortly publish the results of the trials of the other machines.

The appended table (see page 1124) gives the results, showing for each tractor the fuel used (1), the stated H. P., and the sale price without the plough.

1052 - **The Annual Work of a Tractor in France.** — RINGELMANN, MAX, in *Bulletin de la Société d'encouragement pour l'Industrie Nationale*, Vol. 128, No. 4, pp. 126-129. Paris, July-August, 1917.

Information supplied by M. COULPIER to the writer regarding the use of a 20 H. P. EMERSON tractor, owned by the "Syndicat de culture mécanique" of Etampes, Seine-et-Oise, France. The machine, with accessories, cost about £ 555.

From May 1 to December 31, 1916, the tractor was used on 115 days, representing 909 actual hours of work; 449.73 acres were ploughed.

For 1917, the tractor was expected to be used on 170 days, or 1360 working-hours, for ploughing from 662.35 to 667.19 acres at 6 inches depth, which appears to be the maximum. In 1916, the average working day was of 8 hours, during which 3.9 acres were ploughed to a depth of 6 inches; the soil was a sandy clay often difficult to work in hot weather. The wages of the 2 drivers, driving the tractor in turn, was 3s. 2d a day each, plus a bonus of 7.7 d. for each acre ploughed 6 ins. deep. These wages are paid by the employers, who paid about £ 24; the Society paid, for its part, about £ 23 for time in moving from one place to another, stoppages, etc. The total wages paid amount to an average of 3s. 9.4 d. per day for the 245 days, or 7s. 11.86 d. per working day of the 115 actually worked.

(1) The paraffin used in the trials had a density of 0.797 at 15°C; 1 gallon weighed 7.3 lbs. In all the trials the fuel is given by weight. (Ed.).

AGRICULTURAL  
MACHINERY  
AND  
IMPLEMENTS

## Results of ploughing trials.

Machines	Fuel	H. P.	Sale price without plough	No. of order	Labour		Average speed of plough per hour	Average time for turning	Time required to plough 1 hectare (1) hours	Consumption of fuel		Tractive effort		Average speed of plough	Draw-bar pull
					Depth	Breadth of work				per hour	per hectare	average total	average per sq. dm.		
			francs		cm.	metr.	metres	seconds	minutes	sq. metres	kg.	kg.	kg.	m. per second	Kilogram-metres per second
A) Mogul . . . . .	Paraffin	16	9 300	1	12.0	0.91	3 060	30	5h 1 m	1 902	419	543.8	49.8	0.85	462.23
				2	16.7	1.00	2 880	30	4h 49m	2 076	572	835.0	50.0	0.80	668.00
				3	13.8	0.93	2 880	32	5h 4 m	1 974	583	599.1	46.7	0.83	497.25
B) Titan . . . . .	"	20	11 000	4 <sup>(1)</sup>	13.0	0.90	2 916	41	5h 33m	1 128	10.76	Plough 539.3 Harrow 260.2	46.1		6.53
				5	17.8	1.00	2 844	32	4h 54m	2 040	737	Total 799.5		0.81	647.59
				6	12.8	0.96	3 672	32	4h 46m	2 100	738	854.4	48.0	0.79	674.97
C) Ford and Sons. . . . .	"	20	—	7	16.2	0.78	2 042	30	8h 21m	1 200	540	568.5	46.3	1.02	576.87
				8	13.0	0.71	5 472	30	4h 1 m	2 490	786	618.8	49.0	0.57	352.71
				9	16.5	1.37	2 628	30	3h 50m	2 610	530	533.4	57.8	1.52	810.76
D) Big-Four D . . . . .	"	35	—	10	13.0	1.37	3 096	30	3h 18m	3 030	762	1 039.6	46.0	0.73	758.90
				11	14.3	1.06	3 564	30	3h 51m	2 598	576	837.0	47.0	0.86	719.82
				12	16.4	1.10	2 988	30	3h 50m	2 610	602	486.3	45.5	0.99	682.40
E) Emerson . . . . .	"	20	15 000	13	17.8	1.02	3 492	30	4h	2 502	712	829.8	46.0	0.83	685.73
				14	13.4	0.75	3 816	32	5h 4 m	1 980	545	842.1	46.4	0.97	816.83
				15	13.2	1.14	3 816	30	3h 28m	3 030	693	—	—	—	—
F) Moline . . . . .	Petrol	12	9 000	17	13.2	1.14	3 816	30	3h 28m	3 030	693	970.0	64.5	1.06	1 028.28
				18	8.7	1.19	3 132	46	4h 23m	2 280	10.54	740.0	71.5	0.87	643.81
				19	16.0	1.02	3 132	30	4h 15m	2 352	868	1 093.4	67.0	0.87	951.29
G) Rock Island . . . . .	Paraffin	20	14 800	20	18.5	1.04	2 340	34	5h 38m	1 776	712	1 337.1	69.5	0.65	860.16
				22	14.9	0.87	4 248	30	3h 59m	2 508	632	743.2	57.5	1.18	870.33
				23	16.2	0.92	3 060	30	4h 58m	2 016	5.58	752.8	48.0	0.85	607.92
H) Petit Géant . . . . .	"	20	10 300	24 <sup>(1)</sup>	19.2	0.93	2 932	43	5h 23m	1 860	7.46	Harrow 171.7	46.1		8.10
												Total 994.5		0.82	815.59
															10.87
I) Mogul . . . . .	Paraffin	20	10 300	24 <sup>(1)</sup>	19.2	0.93	2 932	43	5h 23m	1 860	7.46	Total 994.5		0.82	815.59

(1) With a length of 150 metres and counting 30 minutes of work per hour, thus allowing for stoppages.

(2) (3) Together with the plough, the tractors B and I also towed a 500 time harrow, with a width of 1.55 metres, working on the widths turned on the previous trip.



Repairs were made on: the fan-pinions; clutch leathers; 2 pinions and gear-wheel rim of the driving wheel (the first gears were replaced after ploughing 24 acres, the second after 27 acres); engine oil-pump; a connecting-rod head, axle-necks and hubs of front-wheels; new piston rings. These repairs cost about £ 55, or the high figure of 9s. 6d. per working day. A large part is due to bad and careless handling by the drivers.

The approximate net cost per acre, in 1916, was:

	£.-s.-d.
A. — Lumpy clay loam, difficult; depth, 5 1/2 ins. . . . .	0-19-0
B. — Clay soil, dry, difficult; depth, 5 1/2 ins. . . . .	6-0-8
C. — Clay soil, worked under good conditions; depth, 6 to 6.3 ins. . . . .	6-0-6
D. — Clay soil, working easily; depth, 6.3 to 7 ins. . . . .	5-12-1

The Society is of the opinion that these cost prices for an acre are in no way excessive.

1053 — **Internal Combustion Farm Drainage Machines.** — *Engineering*, Vol. CIV, No. 2696, p. 228 and pp. 237-238, fig. 5. London. August 31, 1917.

Especially in England, an immense amount of money has been invested in drainage, thus resulting in increased productivity. At present, drainage works are being carried out over large areas and, on account of the scarcity of labourers, machines have been made to remedy the difficulty. Fig. 1 shows the caterpillar type and Fig. 2 shows the ordinary tractor type of the drainage machines made by the PAWLING & HARNISCH-FEGER Co. at Milwaukee, Wis., U. S. A. They are fitted either with a ladder dredger or an excavating wheel, and have given most satisfactory results even in very difficult soils.

The chassis is mounted so as to permit free movement of the axle in passing over uneven ground without affecting the car body proper. It is of structural steel and is so designed that it supports the machinery without any overhanging or eccentric loading.

The machines are equipped to burn either gasoline, kerosene or motor spirit and are provided with a 4-cylinder vertical engine. The internal-combustion engine is water-cooled and circulation is maintained by a centrifugal pump. The tanks are fitted with open screens to ensure better cooling, by exposing the water to the air in a thin sheet.

The machines are steered by means of worm and wheel gears on cross shafts which are chain-connected to the front axle.

The grading operations are controlled by power, by means of gearing connected through friction clutches to the hoisting drums. The excavating wheel is lowered by gear, and is controlled by automatic friction band brakes, which are lined with asbestos. The upright supports, cable sheave supports and connections for the excavating wheel frames are formed by placing 2 heavy channels back to back, a rigid construction that obviates the need for extension guides for the excavating wheel connections. The connection between the excavating wheel frame and the main body is very

strong; it insures facility in raising or lowering the excavating wheel and assists in maintaining a rigid position of the excavating wheel when operat-

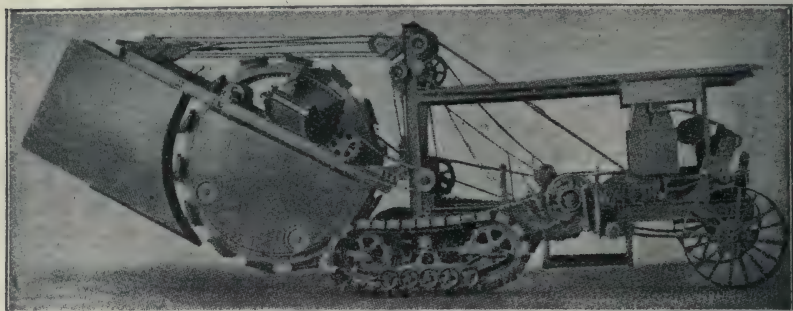


Fig. I. — Caterpillar Type.

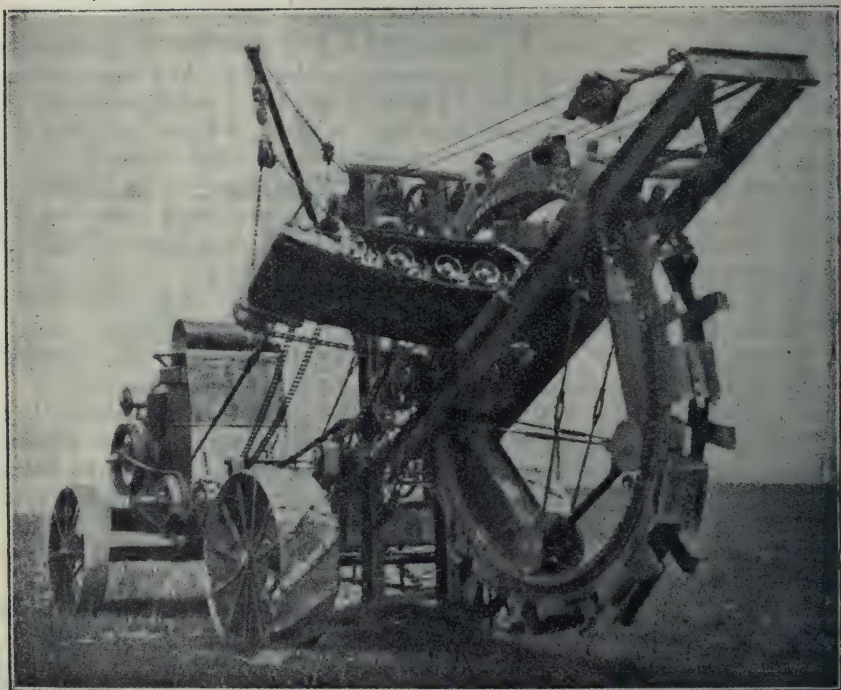


Fig. II. — Excavating wheel type.

ing in frost, cemented gravel or other hard digging. The excavating wheel frame is made of structural steel like the main car body and is very strongly braced; a rigid and heavy construction in the rear is provided for attaching

the cleaning guard and shoe. This gives great stability to the machine and prevents running sideways.

The excavating wheel has no axle and is so arranged as to obtain the maximum depth of trench with the minimum diameter of wheel. This member is made of machine-forged steel angles and plates. The driving gears are of cast steel and are fastened to the wheel member. The buckets are of heavy plough-steel plate, forged to shape and sharpened at the cutting edge.

The double spade cleaner is stationary, being mounted on the frame. These spades clean the bottom, side and top of the bucket. On the larger machines steel slat conveyors deliver the soil on both sides, but clear of the ditch. The conveyors are adjustable in length to suit the depth of the ditch being cut, and are driven from the main wheel driving shaft by a pair of bevel gears. The outer ends of the conveyor are adjustable for height. Ditches dug by these machines are easily back-filled by ploughing in first one side, then the other.

1054 - **Harvesting with Tractors: Trials at Grignon, France, in 1917.** — BERTHAULT, P., in *Journal d'Agriculture pratique*, Year 81, No. 18, pp. 344-345, 2 fig. Paris, September 6, 1917.

Official tests of mechanical harvesters were held, on several days in August 1917, on the estate of the National School of Agriculture at Grignon and on neighbouring farms.

The following tractors were tested :

- 1) 10 H. P. AVERY, towing a 71 in. WOOD harvester-binder. Smooth working, fair speed, doing good work.
- 2) 16 H. P. MOCUL, with a 71 in. OSBORNE harvester-binder. Speed: 2.5 to 3.4 miles per hour, apparently suitable; work well done.
- 3) MOLINE with an 82 in. ADRIANCE-MOLINE binder. Work well done, driving easy, even over difficult ground.
- 4) 18 H. P. CASE (of the Case Co of France), with an 82 in. MASSEY-HARRIS machine.
- 5) AMANCO with a 71 in. MASSEY-HARRIS harvester-binder.
- 6) GLOBE (1), with a 71 in. MASSEY-HARRIS.
- 7) BLUM of Suresnes (Seine).
- 8) XAVIER CHARMES (Émile Mayen Co.).
- 9) FORD of Minneapolis, with a 71 in. WOOD binder.
- 10) BULL, with a 71 in. WOOD harvester.

The FORD tractor from Minneapolis should not be confused with the FORD tractor from Detroit which took part in the Noisy-le-Grand trials; in front it has two driving-wheels, between which is the engine; the steering wheel is in the rear and under the driver's seat.

(1) See Dr. CHAVEAU, *Notes de Culture Mécanique* (Paris, Baillière, 1917), from which the following data relating to this tractor are taken: Weight, 4 730 lbs; 2 cylinder-horizontal engine; 18 H P.; uses petrol; Dimensions, 11 ft. 8 in. X 6 ft. 9 in.; one front wheel and 2 driving-wheels; ploughing can be done with one driving wheel running on the stubble or in the furrow previously turned. (Ed.)



Certain tractors could not continue owing to broken parts. Others worked equally well in wheat, barley and oats. Some were driven too quickly, which is bad, both for the machine and the crop to be gathered, the latter losing the grain on account of the shocks received.

The problem is not that of cutting very quickly, but rather that of cutting at the greatest speed permitting the work to be well done, with little loss of grain.

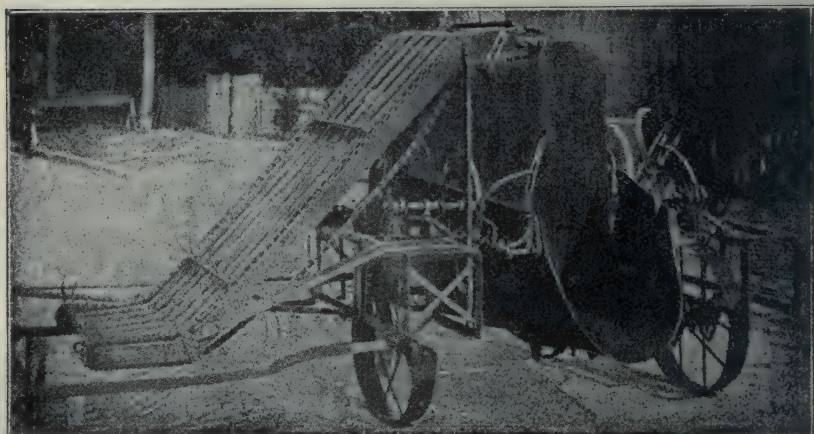
The Grignon trials showed that all the tractors could tow various makes of harvester-binder.

1055 - **The "Bell" Automatic Stooker.** -- *The Implement and Machinery Review*, Vol. 43 No. 509, p. 505, 1 fig. London, September 1, 1917.

The stooking of grain involves considerable labour and expense and in Canada and the United States the production of a simple and efficient stooker has long engaged the attention of many inventors. Mr. H. G. LANCASHIRE has recently invented a machine of this character, shown in the annexed illustration, which can be quickly attached to any make of binder without trouble and without in any way interfering with any working part of the binder.

The bundle carrier on the binder is first removed, and the machine is connected to the binder by means of two angle iron arms, the lower end of the conveyor being then situated immediately under the binder deck. The two arms projecting from the front and inner side of the machine frame are connected by bolt and clevis to the tongue of the binder; thus by means of 4 bolts the binder and stoker are associated as one machine.

The conveyor is self-driven and receives the sheaves as they drop from the binder-deck, these being automatically deposited in the stook-forming basket, which is pivotally suspended between the drive wheels.



*The "Bell" automatic stooker.*

When the driver has sufficient bundles in this basket, he can, by using the binder foot trip, throw the gears into contact, which causes the basket to revolve, the stook dropping on the ground and remaining solidly fixed in the stubble; the basket returns by gravity to its original position. During the time required for this operation, the conveyor remains stationary, and will receive any sheaves which may leave the binder. The basket in finding its original position automatically starts up the conveyor so that the filling can go on as before. The upstanding curved arms seen on the sides of the basket close down immediately the dumping commences and grip the bundles, compressing them together into a solid stook; they release automatically as soon as the basket is in position to drop the stook to the ground.

1056 - **The Ventilation of Hay-Ricks.** — MANRIN, G., in the *Journal d'Agriculture pratique*, Year 81, No. 18, p. 347, fig. 1. Paris, September 6, 1917.

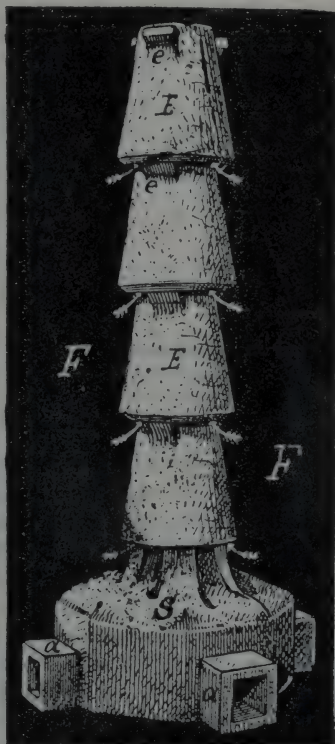
To allow of stacking hay while still damp, and still providing for sufficient drying to prevent heating, pieces of terra-cotta have been used for some little time in Switzerland.

The device, which is shown in the accompanying figure, is invented by A. BRACHER, of Thun (Switzerland), and is known as the EHA system. On the soil, in the middle of the site of the stack, a basal piece *S* is placed, having 4 horizontal openings to which are joined planks or sticks laid in lines. In measure as the stack *F* gradually rises, members *E* are placed one on top of the other, resting on 3 projections *e*, which project from the member immediately below. The members *E* are truncated cones, their internal diameter at the base being much greater than the external diameter of the top of the member placed below. Thus there is an annular space through which air, shown by arrows, can circulate, to pass up the chimney thus formed.

The radius of effect of these ventilators should not be greater than 13 feet; in oblong stacks the distance should be limited to 22 feet.

1057 - **A Milk-Cooler Fixed on a Trolley.** — *Ice and Cold Storage*, Vol. XX, No. 234, pp. 117-118, figs. 3. London, September 1917.

In order that milk should be delivered to the consumer in a pure, healthy condition, it is essential that it should be cooled as soon as it is taken from the cow, and before it is despatched to the centres of consumption.



Terra-cotta ventilators for hay-stacks.



A simple and inexpensive milk-cooler constructed of tin plate is shown in the accompanying figures.

Fig. 1. shows a milk-receiving hopper *H* (removable) with perforations permitting the milk which has passed over the cloth strainer to flow over a conical-shaped surface *S*, the crushed ice being introduced into the body of the cooler by removing hopper *H*. *A* is a metal agitator to keep ice, and subsequently, water from melted ice, in circulation. These coolers can be fixed on a light trolley (fig. 2) for transport when the cows are milked in the field.

The most important advantage of this cooling system consists in the aeration of the warm milk. By circulating a thin film over the surface of the cooler, and by the milk being exposed to a pure atmosphere while it is still warm, all animal taint and odour from roots and other foods would be eliminated from the milk which would therefore considerably improve in keeping power.

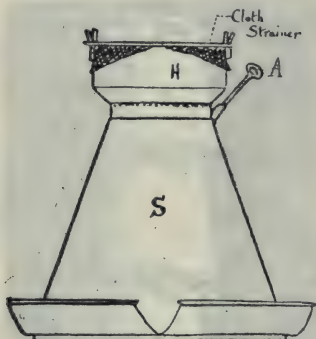


Fig. 1. — Milk-cooler; details of construction.

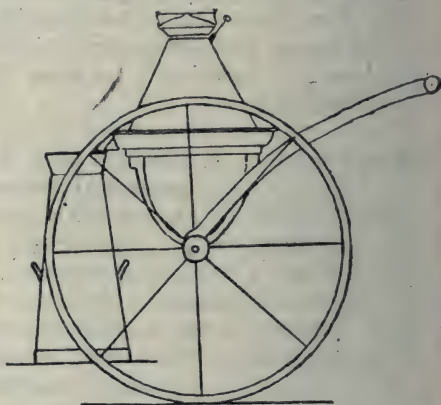


Fig. 2. — The same, mounted on wheels.

To carry out the low temperature cooling immediately after milking, it is necessary that the farmer should be provided with ice. Thus there ought to be in each district a collecting and ice-making station possessing an ice-making plant of sufficient capacity to meet the requirements of the farmers cooperating in the district. At these collecting and ice-making stations situated at railway sidings, all the milk from the district would be collected, weighed and tested. The collection could be done by a motor lorry going the round of the farms. At the collecting stations, the milk could be further cooled if necessary, and then placed for transport in milk churns fitted with dippers provided with crushed ice and covers securely closed and sealed. From the collecting stations the milk could be sent to the distributing dépôt in the consuming centre, or large town, where there would be adequate plant for keeping the milk.

According to the article analysed, this method of milk distribution would be of considerable advantage to milk consumers in large towns.



1058 — **Fuel Alcohol in Australia.** — *The Engineer*, Vol. CXXIV, No. 3222, pp. 278-279. London, September 28, 1917.

The Commonwealth Advisory Council of Science and Industry in Australia appointed a special Committee to investigate the whole question of alcohol and engines. The 1st. report of this Committee deals with the construction of an alcohol engine, the supply of alcohol and the denaturation process.

Alcohol engines are already made in America, England, France, and particularly in Germany. Any petrol engine of the ordinary types can be run on alcohol without material change in its construction, but the consumption of fuel per brake H. P. is about 50 per cent. greater than in the case of petrol. It appears, however, that the consumption of alcohol per brake H. P. in a specially designed alcohol engine will not exceed in volume the consumption of petrol in a petrol engine. The main alterations necessary in petrol engines to fit them to work on alcohol are : 1) an increased compression ; 2) a pre-heating of either the fuel, or the air, or the mixture of air and fuel ; 3) an increase in the area of the fuel jets and fuel supply pipes. In order to start an alcohol engine, the carburetter must be pre-heated, or else a small amount of petrol used. When a temperature sufficient to vaporise the fuel is attained, the alcohol can be gradually turned into the carburetter and the pre-heating of the fuel maintained by the exhaust gases.

The advantages of alcohol are : the products of combustion are practically odourless and free from smoke ; the risks in manipulation are much less than when petrol is employed ; there are many theoretical chemical and physical reasons why alcohol should yield superior results ; there is no danger of pre-ignition under high compression ; alcohol is more homogeneous than other fuels ; alcohol can be produced in largely increased quantities in Australia.

As alcohol is more efficient in engines of low piston-speed and long stroke, the Committee have decided to devote their attention to the design and manufacture of stationary engines.

The problem of distribution of alcohol is not likely to be so serious in the case of stationary engines as for the general adoption of the spirit for motor cars.

The supply of alcohol is the most difficult question, for even if the whole available supply of molasses in Australia were used for distillation, only about 4 million gallons of alcohol could be produced per annum, whereas the annual importations of petrol are about 17 million gallons. About 50 000 tons of molasses are annually produced in Australia of which only a little more than  $\frac{1}{5}$  is now used for making alcohol. The price of methyl alcohol produced from molasses is about 1s. 9d. per gallon. It appears unlikely that any considerable quantity of alcohol can be manufactured in Australia from either raw, or waste, substances such as waste wood, straw, or waste fruit ; cereals or industrial plants such as potatoes and beets might, however, be used.

Various authorities have proposed that alcohol should be used as a fuel in admixture with other materials such as benzine, ether or acetylene.

The main advantage from such an admixture would be that the existing types of engines could be started without difficulty. A new fuel called "Natalite" is formed by a patented process in which the ether and alcohol are manufactured together in the form of a mixture, thus obviating the necessity for first producing the alcohol, and then manufacturing the ether from it. The Committee are making enquiries with a view to the production in Australia of suitable materials to be used as an admixture with alcohol, and as to the efficiency of the various admixtures. The Committee suggest cooperation with the Imperial Motor Transport Council, London, for the purpose of obtaining a denaturant for alcohol which will be generally acceptable throughout the British Empire.

### 1959 - Review of Patents.

#### *Tillage Machines and Implements.*

- |                |            |  |
|----------------|------------|--|
| Austria        | 74 354.    | Device for raising and lowering tractor ploughs.   |
| Italy          | 157 732.   | Motorplough for hill sides with slopes up to 65 %. |
| Switzerland.   | 75 846.    | Attachment for ploughs.                            |
|                | 75 934.    | Power-driven agricultural implement.               |
| United Kingdom | 107 941.   | Plough.  |
| United States  | 1 235 795. | Agricultural implement.                            |
|                | 1 235 891. | Wheeled farming implement.                         |
|                | 1 236 252. | Plough.  |
|                | 1 236 270. | Subsoiling attachment for breaking ploughs.        |
|                | 1 236 344. | Detachable harrow-cultivator.                      |
|                | 1 236 713. | Plough shifter for traction engines.               |
|                | 1 237 182. | Land roller.                                       |
|                | 1 237 194. | Stalk cutter for maize.                            |

#### *Drainage and Irrigation.*

- |               |            |   |
|---------------|------------|---|
| Austria       | 74 282.    | Device for preventing flooding, for draining flat soils and for utilizing watercourses on such lands. |
|               | 74 362.    | Ditching machine for drainage.  |
| United States | 1 235 813. | Lawn or garden sprinkler.   |

#### *Manures and Manure Distributors.*

- |               |            |                         |
|---------------|------------|-------------------------|
| Austria       | 74 358.    | Fertilizer-distributor. |
| United States | 1 235 906. | Fertilizer composition. |
|               | 1 236 358. | Manure distributor.     |

#### *Drills and Seeding machines.*

- |               |                        |                          |
|---------------|------------------------|--------------------------|
| United States | 1 235 606.             | Attachment for planters. |
|               | 1 235 892.             | Lister.                  |
|               | 1 236 028 - 1 236 519. | Planting mechanism.      |
|               | 1 236 377.             | Planter.                 |
|               | 1 236 562.             | Maize planter.           |

#### *Various Cultural Operations.*

- |               |            |   |
|---------------|------------|---|
| Austria       | 74 219.    | Clips for holding vine-shoots together and upright. |
| Switzerland   | 75 847.    | Implement for lifting deep-rooted plants.           |
| United States | 1 235 790. | Garden-hoe.   |
|               | 1 236 045. | Tool for side-grafting-trees and shrubbery.         |

*Control of Diseases and Pests of Plants.*

- Italy 158 083. New spray for vines and olives against peronospora and other fungous diseases.
- 158 214. The use of trichloronitromethane  $C = < \frac{NO_2}{Cl_3}$  (chloropicrine) for destroying plant and animal life deleterious to agriculture, commerce and hygiene.
- United Kingdom 107 651. Fumigator.
- 107 895. Animal traps.
- United States 1 236 629. Insect destroyer.

*Reapers, Mowers and Harvesting Machines.*

- United Kingdom 108 061. Swath turner.
- United States 1 235 601. Fruit picker.
- 1 235 649. Gang lawn mower.
- 1 235 977. Bundle-holder for binders.
- 1 236 018. Grain-shocker.
- 1 236 021. Harvester reel.
- 1 236 680. Shock forming and making machine.

*Machines for Lifting Root Crops.*

- United States 1 235 843. Beet-topping machine.
- 1 235 903. Beet pulling machine.

*Threshing and Winnowing Machines.*

- Austria 74 363. Tray seed dressing machine for separating round seeds from cereals and small leguminous seeds.
- United States 1 235 596 — 1 237 004. Grain separators.
- 1 235 899. Grain winnowing machine.
- 1 236 147. Cotton seed cleaner.

*Machines and Implements for the Preparation and Storage of Grain, Fodder, etc.*

- Austria 74 360. Regulator for setting knives of chaff cutters.
- United Kingdom 108 377. Hay cocker.
- 108 382. Elevator.
- United States 1 235 804. Hay-stacker.
- 1 235 893. Ensilage packer.
- 1 235 975. Hay-baler.

*Forestry.*

- United States 1 235 624. Tree-carrier.

*Steering and Traction of Agricultural Machinery.*

- France 484 236. Tractor for use in vineyards.
- Italy 157 276. Electric tractor for mechanical cultivators and inland navigation.
- United Kingdom 107 625. Tractor.
- United States 1 235 687. Steering mechanism for tractor engines.
- 1 235 822. Tractor.
- 1 235 888. Power steering attachment for traction engines.
- 1 235 915. Traction belt.
- 1 236 813. Automobile-tractor.



*Feeding and Housing of Livestock.*

- Austria 74 218. Horse shoe-nail.  
 Italy 158 065. Immovable identification disk for cattle, which is applied by hand.  
 Switzerland 75 848. Device to guide growing horns.  
 United Kingdom 107 941. Horse-shoe.  
 United States 1 236 203. Horse-shoe.

*Poultry Farming.*

- United Kingdom 107 819. Poultry feeder.  
 108 415. Poultry hopper.  
 United States 1 235 869. Egg-tester.  
 1 235 886. Egg-carton.

*Industries Depending on Plant Products.*

- Austria 74 379 — 74 380. Apparatus for peeling and mashing potatoes.  
 United Kingdom 107 538. Process for brewing light beers.  
 United States 1 235 722. Machine for stemming cured tobacco-leaves.

*Dairying.*

- Austria 74 325. Open-air process for preparing dried milk on drying cylinders heated to boiling point, the milk being fed through a narrow slit.  
 Switzerland 75 873. Churn.  
 75 874 - 75 968 — 75 969. Churns.  
 75 940. Lock for milk cans used for transport.  
 United States 1 235 570. Apparatus for sterilizing milk-cans.  
 1 236 219. Butter-cutter.  
 1 236 413. Apparatus for milking cows.  
 1 237 093. Dairy can.

*Farm Buildings.*

- United States 1 235 588. Post-hole digger.  
 1 236 053. Silo.

1060 - **Small Cold Storage and Dairy Buildings, in Canada.** — RUDDICK, J. A. and BURGESS, J., in *Dominion of Canada, Department of Agriculture, Dairy and Cold Storage Branch, Bulletin No. 49*, pp. 21, plans 7. Ottawa, February 6, 1917.

To reply to numerous requests for information respecting the construction of ice-houses and small cold storages coming from farmers, milk producers, etc., a series of plans has been prepared to satisfy very various conditions.

The 5 plans published refer to the following buildings.

- Plan No. I:* Milk platform with ice house and milk cooling tank.  
*Plan No. II:* Ice house with dairy.  
*Plan No. III:* Ice house with refrigerator and milk room.  
*Plan No. IV:* Farm dairy with insulated ice house and refrigerator.  
*Plan No. V:* Insulated ice house and refrigerator.

The plans (elevations and sections) give all details for construction as well as dimensions. Notes as to foundation, flooring, walls, roofing, doors

and windows, are given with each plan. The work referred to is mainly in wood, but the instructions also apply to stone, brick or concrete buildings.

The vacant space between the double walls is no longer used, insulating material being now used to fill up the space between the walls. The width of the space depends on the insulating material used and on the temperature used in the cold-storage chamber. For a cold-store made of wood planer-mill shavings are the best insulating material to use.

They are cheap, elastic, do not settle readily, and can be obtained in a very dry condition, which is essential. Generally from 7 to 9 lbs. of shavings are required per cubic foot of space.

The shavings are cut from dry lumber, while sawdust is cut from green timber and is generally damp. This dampness destroys their insulating value and encourages the growth of mould and rot, causing a musty odour in the storage room.

It is absolutely necessary to provide against moisture being absorbed by the insulating materials, by using damp-proof paper between the sheathing or boarding of the walls. For brick, concrete, or stone buildings, similar insulating material should be used.

The walls should be given some water-proofing treatment to prevent the absorption of moisture. When shavings are used between brick or concrete walls, the inner surfaces should be coated with pitch, parafin wax, etc. Tar should not be used, alone or in the pitch used on account of its odour.

The dimensions of the ice-chambers depend on the amount of ice used or the purpose of the refrigerator. One ton of ice measures about 35 cubic feet. A consumption of 2 cu. ft. (115 lbs.) per day for four months would amount to nearly seven tons. For such a quantity a building 10 ft square and 10 ft. high will afford ample space for that quantity of ice if properly packed.

*Bulletin* No. 36 of the Dominion of Canada, Department of Agriculture, Dairy and Cold Storage Series gives details of a more complete cold storage designed specially for creamery purposes. Blue prints of the plans described by the writers will be supplied free on application to the Dairy and Cold Storage Commissioner, Ottawa, Ontario, Canada.

## RURAL ECONOMICS.

1061 - A [Survey of Beet-Producing Districts in Minnesota. — PECK, F. W., in *The University of Minnesota Agricultural Experiment Station, Bulletin* 154, pp. 1-36. University Farm, St. Paul, Minn. February 1917.

The Minnesota Agricultural Experiment Station has been receiving numerous inquiries during the past years asking for definite and accurate knowledge of the cost of producing sugar beets and of the gross and net returns per acre; in order to understand the place of this crop in economic production. To obtain such information a survey was made in 1915 of the beet-producing districts in Minnesota. A representative of the Divi-

ion of Agronomy and Farm Management visited each beet-grower who had grown the crop before and obtained the data directly from him. A copy of the blanks used in this survey, reproduced in this bulletin, shows that the data were gathered on the normal acreage, yield, and labour requirements, so that the results represent average costs and returns under average conditions.

To check the accuracy of the survey method of obtaining the 1914 and normal acreages and yields for each farm, the figures given by the grower were compared with those of the sugar company, which were based on actual measurements of acreages and scale weight of beets marketed.

After carefully checking the computations for each grower a report of the result was sent to each, asking that corrections be made of any items which, to his knowledge, were not correct.

A copy of this report is given in this bulletin and shows the method of tabulating and reporting data, which include: *Cost per acre of seed* (stating quantity sown and price), fertilizer, man and horse labour (stating number of hours and price per hour), machinery charge, tax charge, and land rental charge, total cost, direct cost per ton, rental cost per ton, total cost per ton; *value of product per acre*: yield per acre in tons and price per ton, value of tops, total value of crops; *profit per acre*: total value per ton, cost per ton and profit per ton.

*Man labour* constitutes the largest single item of cost in the sugar beet crop, averaging 49.5 per cent. of the total cost of producing beets. If the grower performs the labour without contract help an average of 155.4 hours per acre is required to grow the beets. At 15 cents per hour the man labour cost was \$ 23.31. The professional beet-worker performs the hand operations in 20 per cent. less time than the farmer. In other words, for the hand operations he is one-fifth more efficient on a basis of the actual time required.

Table I gives the hours of labour per acre of hand operations with contract labour (professional) and grower's labour:

TABLE I. — *Hours of Labour per Acre of Hand Operations (1).*

Operations		Contract Labour (Professional)	Grower's Labour
Bunching and thinning . . . . .	Hours	31.57	44.18
Hoeing . . . . .	"	25.51	20.97
Pulling and topping. . . . .	"	26.31	37.82
Total . . . . .	"	83.12	102.97

The average cost per acre of contract labour at 20.6 cents per hour was \$ 17.19; for the grower's own labour at 15 cents per hour, \$ 15.45, and at 20.6 cents per hour, \$ 21.21.

Table II gives the number of hours of man and horse labour required in sugar beet production without contract labour:

(1) Acres considered: contract labour 680; grower's labour 462.



TABLE II — *Labour Requirements for Producing Sugar Beets (1).*

Operation	When performed	Total acres on which data are based	Hours per acre	
			Man	Horse
Manuring	Summer and autumn . .	833.9	9.9	21.7
Ploughing	Autumn . . . . .	1426.0	4.4	13.1
Disking	April-May . . . . .	1134.0	2.3	8.2
Harrowing	April-May . . . . .	1451.4	1.1	2.9
Planking	April-May . . . . .	559.5	0.9	2.1
Seeding	April 25-June 1 . . . .	1458.4	1.3	2.6
Cultivating	May 25 - Aug. 10 . . .	1447.4	11.1	17.2
Bunching and thinning	June . . . . .	462.1	14.2	—
Hoeing	July . . . . .	—	21.0	—
Pulling and topping	October . . . . .	—	37.8	—
Lifting	October . . . . .	1458.4	3.5	6.7
Hauling	October 15-Nov. 15 . .	1458.4	17.9	36.2
Total . . . . .			155.4	110.7

According to Table I the professional beet-worker performed the bunching and thinning, the hoeing, pulling, and topping in 19.5 hours less than the farmer, thereby reducing the total man-hours per acre to 136. When professional beet-workers are employed the farmer performs all operations except those mentioned. The labour of the farmer amounts to but 52.5 hours, indicating that 66 per cent. of the labour is concerned with the three important hand operations.

Where the size of the farm permits, it seems best to grow a sufficient acreage of beets to employ outside labour for the hand operations, and to fit the cropping system to the time requirements so as to use man and horse labour on other crops when not demanded by the beet crop, which competes with corn in June and October and with hay and small grain in July. With the exception of marketing, the farmer's labour on beets is similar to that demanded by corn. Statistics indicate that about 31 hours of man labour and 52 hours of horse labour are required to produce an acre of corn. The agents of the sugar company estimate 7.5 acres of beets to each beet worker. This usually means that a family can care for from 15 to 20 acres.

In view of the special hand labour required and the competition with other farm crops, it is believed advisable to plant a sufficient acreage of beets to warrant the employment of special labour and to arrange for it through the sugar company.

*Horse labour* constitutes 21 per cent. of the cost of producing beets. The crop required 110.6 horse-hours per acre, costing \$ 11.06 at 10 cents an hour. Averaging all farms, with varying operations, gives a cost of \$ 9.97 per acre for horse labour. One third of the horse-time is spent in hauling beets to the loading station.

(1) Not contract labour.

The average rate of seeding was 17 pounds per acre with a seed cost of 15 cents per pound. The cost per acre was \$ 2.57. Machinery cost varied with the use or non use of the manure spreader, but averaged \$ 1.21 per acre.

Taxes were higher on the farms studied than on average farms, because of their proximity to town. They averaged 77 cents per acre.

From 6 to 16 loads of manure were usually applied to the beet crop and the labour of application was the only charge made. This amounted to \$ 3.66 per acre. Commercial fertilizer was applied in five of the eleven localities studied with no results in yields that are conclusive or even indicative of its value.

Land rental constitutes 15 per cent. of the total cost. The average cash rent paid and interest at 6 per cent. on owned land amounted to \$ 7.74 per acre.

The total cost per acre was \$ 47.65. On the average normal yield basis of 9.82 tons per acre the cost was \$ 4.85 per ton. The receipts were \$ 5 in each case, leaving a profit of 15 cents per ton or \$ 1.45 per acre. In addition to the profit the producer received \$ 7.74 per acre of land rent and \$ 23.31 as pay for his own labour and that of his family, a total income, over other expenses, of \$ 32.50 per acre. Where contract labour was employed the producer had \$ 15.31 per acre for rent, for his own labour and for profit.

The yields varied from 5 to 22 tons per acre, with a normal average for three years of 9.82 tons. These were the actual scale weights from the sugar company books. The tops are a valuable by-product of the beet crop. The value depends on the kind and quality of stock fed and the manner of storing and feeding. An average of the estimates of the growers was \$ 4.40 per acre.

A great factor in the popularity of the sugar beets is the increase in grain yields the following year. Conservative estimates place the increase of wheat at 6 bushels per acre or over 30 per cent., and the increase of barley and oats at 4 to 6 bushels.

1062 - The Cost of Food in Egg Production. — See No. 1048 of this Review.

## AGRICULTURAL INDUSTRIES.

1063 - Plastering of Grapes and the Increase of Acidity and Sulphates in the Wine: Investigations in Italy. — BORNTAEGER, A., in the *Giornale Vinicolo italiano*, Year 43, No. 35, pp. 412-414. Casale Monferrato, September 2, 1917.

It is well known that the addition of calcium sulphate to grapes at the time they are put in the vat causes an increase in the acidity of the wine. The reaction which takes place between the calcium sulphate and the cream of tartar is the following (CHANCEL's equation) :



One molecule of free tartaric acid is, therefore, formed per 1 molecule of neutral potassium sulphate, i. e., 150 grm. of tartaric acid for 177.4 of

sulphate. In reality, however, the increase in acidity may be much below that corresponding to this ratio.

L. MAGNIER DE LA SOURCE attributes this fact to the presence, in the grape, of a large quantity of neutral potassium compounds, derived from organic acids other than tartaric acid, which are decomposed by the addition of calcium sulphate; he even admits the action of the colouring matter.

ROOS and THOMAS admit the presence, in wine, of a large number of organic potassium compounds, amongst which there are some whose part which represents the acid does not possess all the properties of acids properly speaking.

The difference between the true increase in acidity and the calculated increase in acidity was also present in experiments carried out by the Author with white "Catalanesca" grapes from Vesuvius. With the same kind of grape the Author prepared three wines: a natural wine (I) and two wines (II and III) containing different amounts of pure calcium sulphate, free from carbonate or oxide. This experiment was repeated in 1914. In 1916 only two wines were made; one natural and one containing calcium sulphate.

After vatting and filtering, the sulphates ( $K_2SO_4$ ) and total acidity expressed as free tartaric acid were determined in the 8 wines. The following results were obtained.

Wine		$K_2SO_4$ ‰		Acidity ‰		
		found	increase	calculated	found	difference
1913 . . . . .	I	0.24	—	—	6.90	—
	II	2.99	2.75	9.27	7.40	1.87
	III	5.60	5.36	11.51	8.10	3.41
1914 . . . . .	I	0.33	—	—	6.00	—
	II	3.70	3.37	8.90	8.50	0.40
	III	3.74	3.41	8.94	8.70	0.24
1915 . . . . .	I	0.55	—	—	5.64	—
	II	5.98	5.43	10.31	6.28	4.03

The Author believes that the fact that, in the treatment of the grapes with calcium sulphate, the increase in the acidity of wine may be inferior to that corresponding to the increase of sulphates, may be explained less artificially than has been done by MAGNIER and ROOS & THOMAS.

According to him the following are the 3 principal causes:

1) The tartaric acid liberated at the beginning reacts, in the presence of the alcohol and neutral potassium sulphate formed, on the neutral potassium compounds of other organic acids (malic, lactic, succinic, acetic) contained in the wine and, as a result of the precipitation of part of the cream of tartar (an acid salt) formed, the true acidity of the wine is inferior to that which would be found if all the tartaric acid remained in free solution.

2) Calcium sulphate is one of the sulphates which are determined in the mass in wines treated with calcium sulphate and expressed as per 1000



of neutral potassium sulphate. Its solubility in water is greatly increased by the presence of certain neutral salts of potassium and organic acids, salts which are present in wine (malate, acetate, etc.). The tartrate acts on the acid group, transforming it into neutral potassium sulphate, while the calcium tartrate is precipitated. On the other hand, the increase in the solubility of calcium sulphate as a result of the presence of the free organic acids of the wine (e. g., tartaric, malic and acetic acids) is very slight or even nil.

3) Tartaric, malic and acetic acids (in decreasing order of importance) slightly decrease the quantitative result of treatment with calcium sulphate where the sulphate content and the acidity of the filtered wine are concerned. This has been proved by the Author's experiments with cream of tartar, pure calcium sulphate, and with water in a quantity insufficient to dissolve all the bitartrate. On the other hand, their neutral salts increase the apparent calcium sulphate content, but increase the acidity to a much slighter extent. Tartrate, on the contrary, greatly diminished the acidity.

The Author's experiments show that only a part of the sulphates in wines treated with calcium sulphate really result from the action of the calcium sulphate on the cream of tartar and the formation of tartaric acid. A certain proportion of the sulphates (even of the calcium sulphate) dissolves without the formation of free acids.

1064 - **Wine Making Experiments with Sulphur Dioxide in Italy.**—MENSIO, C., in *Le Stazioni sperimentali agrarie italiane*, Vol. I., Pt. 6-7-8, pp. 300-314, 10 tables. Modena, 1917.

The author made many wine-making experiments with various similar products containing sulphur dioxide, phosphoric acid, ammoniacal nitrogen, etc. The products, sold under different names (biosulphite, sulphophosphate, etc.), are recognised as being excellent substitutes for sulphur dioxide either as liquid, gas or combined, for example, as potassium metabisulphite.

The experiments were made with black grapes from Torre dei Passeri, which arrived in Asti after travelling for several days in baskets, and, consequently, were not only in fairly bad condition, but also contained an abundant cryptogamic flora. The author preferred to use such grapes rather than healthy ones, so as to observe the better the subsequent action of the sulphur compounds, more especially on the principal characteristics, that is to say, the intensity and shade of the colour of the wine.

Five experiments were carried out, each with selected yeast and 1 hectolitre of grapes:

No. 1 — control; 1 hectolitre of grapes.

» 2 — 1 hectolitre of grapes + 50 cc. of OTTAVI mixture.

» 3 — 1        »        »        »        + 50 cc. of HUBERT sulphophosphate

» 4 — 1        »        »        »        + 50 cc. of JACQUEMIN bisulphite.

» 5 — 1        »        »        »        + 25 cc. of potassium metabisulphite.

*Composition of the sulphur compounds used (in grammes per cc. of liquid)*

	Ammonia	Sulphur Dioxide	Phosphoric Residue
OTTAVI . . . . .	7.5 gr.	16.0 gr.	5.1 gr.
HUBERT . . . . .	7.2	23.4	7.6
JACQUEMIN . . . . .	1.8	15.1	3.7
METABISULPHITE . . . . .	—	53.0 %	—

The results of the analyses of the wines obtained are given in 10 tables, and the conclusions drawn from them may be summarised as follows:

The most important result is that wines made with sulphur compounds have a brighter and more brilliant colour, and a greatly increased intensity of colour. If the intensity of colour of the control wine be placed at 100, that of wines Nos. 2 and 4 is 133, and that of wines Nos. 3 and 5, is 135 and 143 respectively.

Potassium metabisulphite is more efficacious than the other sulphur compounds, though only slightly so. This would seem to prove that the increase in colour is determined by the sulphur dioxide rather than by the phosphoric acid present in experiments Nos. 2, 3 and 4.

The use of sulphur compounds caused, as compared with the control:

an increase in alcohol content of . . . . .	0.2	to 0.3	cc. %
» » » extracts of . . . . .	1.6	to 2.7	grm. per litre
» » » ash of . . . . .	0.09	to 0.27	» » »
» » » phosphoric residue (Nos. 2, 3 and 4) . . . . .	0.020	to 0.050	» » »
» » » sulphuric residue . . . . .	0.037	to 0.054	» » »
» » » total nitrogen (Nos. 2 and 3) . . . . .	0.013	to 0.017	» » »

About 80 % of added sulphur dioxide remains in the wine. The greater part of this is combined (as a result of its action on the acetic aldehyde) under the form of acetaldehydic sulphurous acid, capable of setting free equivalent quantities of organic acids.

The glycerine content of all the wines is very low, the amount corresponding to 100 gm. of alcohol being only about 6.8 gm., that is to say, below what is usually considered the minimum.

There is no trace of ammonium salts in any of the wines, not even in Nos. 2, 3 and 4, which had received a small quantity of such salts in the sulphur compounds added.

The undetermined extracts amounted to about 5.5 to 6.5 gm. per litre.

The total acidity is higher in the wines made with sulphur compounds than in the control (3 to 4 cc. of N. solution more per litre). The same result was obtained for organic acids (2 to 6 cc. of N. solution more per litre). On the other hand, the volatile acidity is lower in such wines than in the control (2 to 3 cc. of N. solution less per litre).

All the results show that the use of sulphur dioxide under any form is very advantageous in wine-making.

Preparations containing sulphur dioxide combined with phosphoric acid and ammoniacal nitrogen, are not preferable to metabisulphite which, on the contrary, gives better results.



- 1065 - **The Substitution of Calcium Sulphite for Potassium Metabisulphite in Wine-making.** — SANNINO, F. A., in *La Rivista di Viticoltura, Enologia ed Agraria*, Year XXIII, Series V, No. 19, pp. 330-331. Conegliano, October 1st., 1917.

As a result of the war and the consequent cessation of imports from Stassfurt, potassium salts have become very dear. For this reason the author studied the possibility of replacing potassium metabisulphite by other products capable of giving the same results (1). Besides sulphur dioxide, prepared by burning sulphur, aqueous solution of sulphur dioxide and must containing a known quantity of either sulphur or anhydride, pure calcium sulphite may be used in musts rich in total or free acids.

In such musts, pure calcium sulphite (i. e. containing no calcium carbonate and 40 % of  $\text{SO}_2$ ) decomposes rapidly and completely with formation of sulphur dioxide. It is necessary to use rather a larger quantity than would be required in the case of potassium metabisulphite (which contains 50 % of  $\text{SO}_2$ ); for example, instead of 10 grms. of this latter salt per quintal of grapes, 15 grms. of pure calcium sulphite may be used.

- 1066 - **Morizot Acidimeter for the Rapid Determination of the Acidity of Musts and Wines.** — MORIZOT, P., in *Revue de Viticulture*, Year 24, Vol. XLVII, No. 1214, pp. 216-219, 1 fig. Paris, October 4, 1917.

The new acidimeter consists of a graduated tube. Into one end, slightly larger in diameter than the graduated part, is poured the wine or must through the opening at the other end, till it reaches the line marked *test*. The space between this mark and the one immediately above it, which corresponds to *zero* is filled either with a few drops of some indicator or water. The graduated part above expresses the acidity in tartaric acid on one side and in sulphuric acid on the other. The open end of the tube is joined to a small conical flask with a ground-glass joint.

The wine or must is measured in the tube as described and, for musts or white wines, phenolphthalein poured in up to the zero mark, or for red wines, either water or a little calcium chloride solution. The flask is then joined on, and the apparatus turned upside down so that the liquid passes into the flask. The tube is left a few seconds above the flask to allow the liquid to drain well into it. The tube is then separated from the flask, to which an acidimetric solution is added without loss of time till the colour changes. The flask is again joined to the tube, into which the liquid is repoured, and the acidity read off immediately. The exactitude of the results obtained is very satisfactory.

The acidimeter is very suitable for heating wines in order to expel the carbonic acid contained in new wines. The heating should be done in the flask, and, after cooling, it is well to verify the volume of the wine by passing it into the measuring tube and, if necessary, making it up to the original volume with a few drops of water.

The acidimeter is also well adapted to the estimation of the total acidity of vinegars, either during or after manufacture.

(1) As regards the substitution of sodium metabisulphite for potassium metabisulphite, see, *R.*, August 1917, No 766. (Ed.)



1067 - **The Degree of Bolting : Food Value and Digestibility of Bread, Better Utilisation of Wheat.** — I. LAPICQUE, LOUIS, in *Comptes rendus des Séances de l'Académie des Sciences*, Vol. 165, No. 13, pp. 413-415. Paris, September 24, 1917. — II. BERTRAND, GABRIEL, *Ibid.*, Vol. 165, No. 14, pp. 438-440. Paris, October 1, 1917.

I. — It is frequently stated, especially now that the percentage of flour extracted from wheat has risen in France from 80 to 85 %, that the utilisation of wheat as a human foodstuff reaches its maximum when the extraction of flour is limited to the percentage which, if it does not supply a white bread, at least supplies a brown bread.

It is perfectly true that white bread, *in equal weight*, contains more nourishment than brown, and that brown bread contains more than that in which all the bran is present. The food value of the wheat (in other words, the amount of human subsistence obtained from a given quantity of wheat) is, not the food value of the bread, but the product of this value by the quantity of bread obtained.

The Author's experiments gave, as general averages : 72 % white bread, 3.6 cal. per gramme ; Graham wholemeal bread, 3.3 cal. These are net calories, i. e. the difference between the combustion heat of the bread eaten and that of the actual or assumed corresponding faecal matter. In equal weights, wholemeal bread is the less nourishing. In proportion to equal weights of wheat, however, 72 % white bread gives 3.6 cal.  $\times 72 = 259$  cal. and wholemeal bread, 3.3 cal.  $\times 100 = 330$  cal. By extracting only 72 % there is a loss of 71 cal., or nearly 22 %.

For average wheat, 85 % bolting is certainly an advantage over any lower percentage, but the experiments now in progress are not yet sufficiently advanced to determine the exact extent of this advantage. It seems that, of the 5 parts added by raising the percentage from 80 to 85, 4 are effective, thus improving the yield of the wheat by 5 %.

II. — Mr. GABRIEL BERTRAND criticises Mr. LAPICQUE's paper.

He calls *coefficients of digestibility* of wheat consumed as bread the products obtained by multiplying by the degree of bolting the figures which show the loss in substance and the loss in energy suffered by each flour in its passage through the organism (losses calculated by chemical analyses and calorimetric determinations of the food and excreted matter).

The experiments carried out in America from 1899 to 1905 by SNYDER, WOODS and MERRILL, confirm the chemical studies of GIRARD and FLEURENT by proving clearly the superiority of white flour over those of a higher bolting percentage. The Author expresses his opinion on this subject as follows :

When passing from a white bread obtained from 72 % fine flour to brown bread made with 85 % flour, as is compulsory today, it is perfectly true that there is an increase, in calories, in the coefficient of digestibility of wheat, of about 8 % in absolute value, or about 12 % in relative value. The advantage would appear to be with the flours with a high extraction percentage, but other considerations tend to reduce it to a marked extent.

In the first place, it is the bad quality of the grain which increases the

ratio of the weight of the husk to that of the kernel, then comes the increased work required for the digestion of food containing more inactive matter.

If the organism used everything which enters the alimentary canal for its nutrition, the coefficient of digestibility would merge with that which may be called the coefficient of utilisation, and the only interest to be considered would be the extraction of 85 % of flour from the grain instead of 72 %. But the American investigations have shown that, in 85 % bread, the undigested part of the masticated food is 3 or 4 times greater than that of 72 % bread. The work lost in the mastication, reduction and internal transportation of this excess of inert substance has, naturally, to be deducted from the 8 % calculated above. It may, thus, be asked if the advantage gained is sufficiently great to counterbalance, on the one hand, the many disadvantages of 85 % bread, and, on the other, the decreased amount of food stuff available for farm animals as the result of so high an extraction percentage. This question is still undecided from a theoretical point of view.

By limiting the extraction to 80 parts of flour of the 100 parts of grain (with an assumed weight of 61.6 lbs. per bushel) a coefficient of digestibility of about 72 % would be obtained. This is very close to that of 85 % flour, so that the coefficient of utilisation is about equal, and the greater part of the faults of the present day bread would be obviated, while the percentage of grain left for live-stock ( $\frac{1}{3}$  in weight, and more in food value), a factor indispensable both to the food supply and agricultural production, would be greatly increased.

1068 - **Method for Estimating Bran in Flour and Bread.** — LEGENDRE, R., in *Annales des falsifications et des fraudes*, Year 10, Nos. 105-106, pp. 293-296. Paris, July-August, 1917.

The method described is simple and rapid, and the only chemical required in 45° B. phosphoric acid, which isolates the fragments of cellulose. If the flour and the bread made from it are treated simultaneously for the same length of time, the amount of cellulose fragments obtained may be compared.

Two grammes of flour and three of bread-crumbs are weighed in order to allow for their difference in moisture content (flour : 10 to 15 % of water ; fresh bread-crumbs : 40 to 45 %). Each sample is put into a test-tube into which are poured 10 cc. of water and 10 cc. of 45° B. phosphoric acid. The tubes are put in the autoclave at 120° F. and left there for an hour, when they are taken out and left to cool. The contents of each tube are then poured on to a previously moistened No. 120 or 100 silk strainer, and the bran on the strainer is washed with water until the water from it is perfectly clear. The bran is then collected and poured into a test-tube, the strainer being put over a funnel which enters the tube, and washed with water from a pipette. The mixture is left till a deposit forms and then centrifuged. The two residues should be about equal in volume.

The same method may be used for paste and semolina, care being taken to soak them previously and to prolong the time during which they are autoclaved.



1069 - **The Use of Brewers' Yeast in Bread-Making.** — BAKER, J., in the *Journal of the Society of Chemical Industry*, Vol. 36, No. 14, pp. 836-839. London, July 31, 1917, and in *Brasserie et Malterie*, Year 7, No. 13, pp. 198-203. Nancy, September 20, 1917.

Great economic advantages would be gained in bread-making by the use of brewers' yeast, which only costs £2 to £4 per ton whereas distillers' yeast which, before the war cost £30, now costs £100 per ton.

Experiments made with yeast from the different fermentation systems used in brewing are described.

Brewers' yeast may be used without any treatment, but, in this case, there is danger of a bitter taste; it is best to wash it with a very dilute solution of brine and to subject it to a short, but brisk fermentation in a dilute mash-tun wort.

Yeast thus obtained may be used with distillers' yeast with satisfactory results. The proportion used may be 33 % or 50 %, according to the type of bread. It is advisable to prolong the doughing period for about an hour. With the ordinary "quick doughing" process brewers' yeast by itself is useless, but it gives good results when used alone with the "slow doughing" process.

1070 - **The Use of Calcium Glucosates in Bread-Making.** — LE ROY, G. A., in *Comptes Rendus des Séances de l'Académie des Sciences*, Vol. 165, No. 13, p. 416. Paris, September 24, 1917.

Calcium glucosates may advantageously be used in the place of lime-water in order to improve, from the point of view of taste, food value and keeping quality, bread made with flour of a high bolting percentage, such as the 85 % flours compulsory in France at the present time.

The glucosates are prepared by the digestion, in the cold, of an aqueous solution of commercial glucose (free from the traces of arsenic sometimes found in these products) with milk of lime. After filtration a clear solution of glucosates is obtained which, according to the respective proportions used, contains 1 part of calcium to every 1 or 2 parts of glucose. As these solutions may be made fairly concentrated, they are easier to use in bread-making than lime-water, the aqueous solution of which can only contain about 1 gramme of calcium per litre.

In his experiments, the Author used for 100 kg. of 85 % flour kneaded with the usual quantities of water, yeast and common salt, quantities of glucosate solution representing 100 grm. of glucose and 50 grm. of calcium. This corresponds to about 1 grm. of glucose and 0.5 grm. of calcium per kg. of bread made.

The bread thus made was of a better quality than that made with lime-water under the same conditions. Fermentation, which appears to be slightly retarded with lime-water, seems, on the contrary, to be accelerated by the glucosate.

1071 - **Beech-Oil.** — TRUELLE, A., in *La Vie agricole et rurale*, Year 7, No. 38, pp. 209-210. Paris, September 22, 1917.

The nuts of *Fagus sylvatica*, or common beech (Amentaceae), contain



from 15 to 20 % of edible oil, which, during the war at least, might be profitably extracted for use as a foodstuff. About half a century ago the extraction of this oil in Compiègne (France) was a fairly important source of income for the inhabitants. In good years a strong beech will yield  $2\frac{3}{4}$  bushels of nuts, but a heavy yield is only obtained every four or five years. According to FORTHIER, 1 acre of beeches may give about 56 bushels of nuts, that is to say, about 4 cwt. of oil.

The seeds are crushed in water (1 litre of water per 33 lbs. of kernels). The paste, subjected to pressure in the cold, yields 14 to 16 % of oil. The residue, collected in hot water and crushed again, gives 3 to 4 % of oil.

If, from the beginning the material is crushed when hot, 18 to 20 % more oil is obtained, but it is slightly bitter and of inferior quality.

The average yield for decorticated nuts is 15 %.

Beech-oil obtained from material treated in the cold is viscid, of a pale yellow colour, with a slight smell and a sweet taste. When extracted in the hot, it has a slightly bitter taste, which disappears with time, but which may be removed almost immediately by shaking with water, in which the bitter element is soluble. It keeps for a long time without changing, and even improves with age. It is edible. The worse quality oil is used especially for lighting and soap making.

Its density at 15° is 0.9205; rise of temperature with sulphuric acid + 65°; polarisation = - 0.8° in saccharometric degrees; oleorefractometer = + 16.5° to 18°; iodine index = 104.39; bromine index = 0.652.

There are two kinds of beechnut cake, one made from decorticated nuts (decorticated cake), the other from non-decorticated nuts (crude cake); the first kind is superior to the second in food value. Non-decorticated cake has a harmful effect on domestic animals, especially on horses, and should be used for manure or heating (being burnt in the same way as peat). Decorticated cake may be used as a foodstuff for domestic animals (1).

1072 - A Coffee Substitute, Prepared from the Seeds of *Cassia Tora*. — See No. 1022 of this Review.

1073 - The Fibre of *Hedychium coronarium* as a Raw Material for Paper-Making. — See No. 1020 of this Review.

1074 - The Sterilisation of Milk by the Lecomte Method; Tests made in Holland. — I. In en Uitvoer, Year 2, No. 30, pp. 646-647. Amsterdam, July 25, 1917. — II. Nederlandsche Weekblad voor Guivelbereiding en Vedeelt, Year 23, No. 19, p. 1. Doetinchem, August 7, 1917.

The LECOMTE method of milk sterilisation consists in placing the milk in an hermetically sealed vat with a metal cover. By means of an air-compressor, there is passed through the vat a current of air at 2 atmospheres pressure from an apparatus ("transformator") in which the air is impregnated with an unspecified gaseous substance. The milk in the "impregnation" vat is not heated, but is subjected to the action of the current

(1) See B. 1913, No. 957.

(Ed.)

for 10 minutes. The milk is then put into bottles which are completely filled and closed with metal caps.

The bottles are then placed in an autoclave filled with water and heated to 115-120° C. When this temperature is reached the hot water is drawn off and a current of cold water passed through. In less than one minute the internal temperature drops to below 80° C. Cooling is continued, the cover then removed and the bottles taken from the autoclave. Milk thus treated has no boiled taste, but resembles fresh milk in every respect.

Experiments made in Dutch laboratories showed the milk to be sterile and free from antiseptic. Nevertheless, it is still necessary to investigate the behaviour of the vitamins and the value of milk thus sterilised from the point of view of digestibility. License to use the patent is granted by the "Society for Dairy Research and Dairy Apparatus" of Amsterdam on payment of 0.1 cent (1 cent = 0.20d. at par) per litre of milk treated.

Baron PEERS, of Belgium, after having assisted at a demonstration, stated that :

- 1) The milk after sterilisation at 115° C. had no boiled taste and no colour, and had the appearance of raw milk.
- 2) The apparatus is very simple.
- 3) The breakage of bottles is very slight: one or two per thousand.
- 4) The method is rapid (less than 1 hour the whole operation).

1075 - **Cooling Milk on the Farm and the Organisation of its Subsequent Distribution by Means of Central Stations.** — See No. 1057 of this *Review*.

1076 - **Cooling Milk on the Farm.** — HUNZIKER, O. F., MILLS, H. C. and SWITZER, H. B., in *Indiana Station Bulletin* No. 188, pp. 1087-1118, figs. 16. Lafayette, Indiana, 1916: Summarised in *Experiment Station Record U. S. Department of Agriculture*, Vol. 35, No. 9, pp. 874-875. Washington, D. C., 1917.

In order to test the effects of cooling cream, the writers used in their experiment 2 lots of cream of similar quality under similar sanitary conditions. One lot (cream *A*) was kept in cream-cooling tanks; for the other lot (cream *B*) no special cooling tanks were employed. During the experiments, the difference between the air temperature and that of the water used in the tanks was comparatively slight. Notwithstanding this fact, it was found that the use of the cooling tanks produced a very marked improvement in the quality of the cream and of the butter made therefrom. Cream *A* averaged 0.38 per cent. acidity and the butter gave 91.25 per cent. of fat, while cream *B* averaged 0.52 per cent. acidity and gave 88.75 per cent. of fat. It was noted that, while cream *A* had retained its clean flavour, cream *B* had in most cases a disagreeable taste. Bacteriological analysis showed that the average reduction of micro-organisms ascribed to the use of the cooling tanks was 35 per cent. of the total bacterial content; 35.8 per cent. of the lactic acid bacteria, 72 per cent. of the liquefiers, and 75 per cent. of the undesirable yeasts and moulds. In fermentation tests, cream *A* produced a solid curd with a sharp separation of clean whey; the majority of the fermentation tests from cream *B* showed a gassy curd, and in some cases the curd underwent decomposition.



Analyses of all the experimental butter for moisture, salt and curd showed about the same average percentages for each lot of butter. Bacteriological analyses of butter showed the following reductions ascribed to the use of the cooling tank; total bacteria, 58.6 per cent., acidifiers, 60.2 per cent., liquefiers, 81.9 per cent., and yeasts and moulds, 87.4 per cent.

The average fat-content of the butter made from cream B was 88.98 % at the Station, and 87.69 a fortnight later at New York; and for the butter made from cream A, 91.63 % at the Station and 89.7 at New York. On the open market in New York, the price received for butter made from cream A was 24.88 cts. per pound, and for butter made from cream B 23.94 cts. per pound.

The writers point out the essential features of satisfactory cream-cooling tanks, give notes on the use of springs and wells for cooling cream, and describe several types of home-made and commercial cooling tanks.

1077 - **Causes of Variation in Cream Tests.**— WIANCKO, T. A. F., in *The Agricultural Journal of the Department of Agriculture of Victoria, R. C.*, Vol. 2, No. 5, pp. 86, 95, 98. Victoria, British Columbia, July 1917.

One of the most frequent causes for complaint by patrons of creameries is the frequent and almost unexplainable variations of the cream test, which have in many cases led to lack of harmony between the patron and the creamery.

A great deal of this trouble arises from a lack of thorough understanding of the simple cause for these variations, and of the principles underlying the proper handling of the cream separator.

Factors affecting the percentage of fat in cream, other than possible inaccurate sampling and testing, may be summarized as follows:

- 1) Richness of the milk separated.
- 2) Changes in the temperature of the milk.
- 3) Speed of the separator-bowl.
- 4) Rate of inflow to the separator-bowl.
- 5) Amount of skim-milk or water used in flushing the separator-bowl
- 6) Cleanliness of the separator.

Each of these factors is separately considered by the Author as follows:

1) It is a well known fact that the milk from the same herd will vary greatly from day to day; feed, care and handling being under the same conditions. There seems to be no accounting for these variations. They seem to be entirely owing to the temperamental individuality of each cow, varying from day to day and from one milking to another.

The influence of the fat-content of the milk on that of the cream is well shown by the following results of an experiment made in Indiana, U. S. A.:

Percentage Fat-content		
Milk	Cream	Skim-Milk
3.0	20.0	0.06
4.5	32.5	0.06
6.0	39.0	0.14



2) Milk should be separated when fresh and new, or at a temperature of 90-95° F. Milk at a lower temperature becomes thicker or more viscous than the same milk would be at a higher temperature, and will therefore not flow into the separator quite so readily, the centrifugal force being allowed to act on the milk for a longer time, narrowing the cream-line, which means less cream, but of a higher percentage of fat. The colder the milk, other conditions being equal, the richer the cream, because the same amount of force is applied to a smaller inflow.

The influence of the temperature on the fat-content of the cream is shown by experiments made in Indiana (U. S. A.) and Ottawa (Canada), the results of which are quoted below.

*Influence of the temperature of the milk. Experiments made in Indiana.*

	Temperature of milk	% Fat in Cream	% Fat in Skim-Milk
Lot 1 . . . . .	90-95° F	21.2	0.02
» . . . . .	50-60° »	31.7	0.75
Lot 2 . . . . .	90° »	27.3	0.022
» . . . . .	75° »	28.5	0.051
» . . . . .	60° »	36.7	0.120

*Influence of the temperature of the milk. Experiments made in Ottawa.*

% Fat in Milk	Temperature of Milk	Lbs. Cream per 100 lbs. Milk		% Fat in Cream	% Fat in Skim Milk
		Lb.	oz.		
3.57	70° F	8	0	44.2	0.040
3.57	75°	8	14	40.0	0.033
3.57	80°	10	0	35.5	0.021
3.57	85°	10	11	33.1	0.028
3.57	90°	11	2	32.0	0.017
3.57	95°	12	2	29.3	0.021

This latter experiment gives a variation of 14.9 % fat in the test of the cream in these different lots of milk with all conditions the same except the temperature of the milk. The amount of cream per hundredweight of milk decreases with the temperature of the milk, while the percentage of fat lost in skim-milk increases with the low temperatures.

3) The effect of speed of the separator bowl on the percentage of fat in the cream is probably greater than any other cause. Variations in speed may cause a difference under ordinary conditions of from 5 to 20 per cent. fat in the cream separated, the difference in richness being greater when the machine is set for thick cream than when set for thin cream.

*Influence of the speed of the separator-bowl. Experiments made in Indiana.*

	Speed of bowl	% Fat in Cream	% Fat in Skim-Milk
Lot 1	Normal Speed . . . . .	28.5	0.029
	10 turns too high . . . . .	32.0	0.029
	10 turns too low . . . . .	23.0	0.210
Lot 2	Normal Speed . . . . .	42.2	0.060
	10 turns too high . . . . .	51.0	0.040
	10 turns too low . . . . .	33.0	0.130

In Ottawa experiments, five turns per minute under the proper speed resulted in a difference of 6.7 %, and ten turns too low made a difference of 10.9 per cent. The difference in the test between five turns too fast and ten turns too slow was 17.4 per cent. Turning too slowly also increases the fat lost in the skim-milk. Both the turning movement and its speed should be very *regular*.

If from neglect the separator is not kept properly oiled and cleaned in all its bearings it will gradually become harder to turn, and speed will be kept up with much more difficulty, almost invariably resulting in cream with wider variations in the test because of a varying speed. An unbalanced bowl also tends to shake up the cream-line inside the bowl and yield a thinner cream and a consequent loss of fat in the skim milk.

*Influence of the balancing of the bowl. Experiments made in Indiana.*

	Balanced bowl	Unbalanced bowl
Percentage of fat in cream . . . . .	31.0%	28.30%
Percentage of fat in skim-milk . . . . .	0.03	0.17

4) The amount of milk in the supply-tank affects the percentage of fat in the cream. The more milk in the tank the more rapid the inflow caused by greater pressure, which consequently results in thinner cream.

*Influence of the amount of milk in the tank. Experiments in Indiana.*

		% Fat in Cream	% Fat in Skim-Milk
Lot 1	{ Normal flow . . . . .	44.3	0.060
	{ Small flow . . . . .	70.0	0.080
	{ Large flow . . . . .	32.8	0.190
Lot 2	{ Normal flow . . . . .	29.0	0.028
	{ Small flow . . . . .	30.0	0.027
	{ Large flow . . . . .	23.0	0.145

The above table shows a decrease of from 6 to 12 per cent. fat in the cream of the larger inflow over that of the normal inflow and a considerable loss of fat in the skim-milk from the large inflow.

5) A decrease of from one to ten per cent. fat in the cream may be caused by variations in the amount of flush-water or skim-milk used.

*Influence of the amount of flush-water used. Experiments in Indiana.*

Amount of flush-water	% Fat in Cream
None . . . . .	37.3
Same as capacity of bowl . . . . .	37.3
Enough to make cream discharge watery . . . . .	35.0
Twice the last amount . . . . .	33.5

6) When the separator is not kept properly cleaned after each time of using, it has a measurable effect upon the speed at which the milk flows through the machine, and when by reason of not being properly cleaned the skim-milk outlets become partially clogged with separator slime or other residual matter, more milk must pass through the cream-screw along with the cream, and in consequence will yield a lower testing cream.

CONCLUSION. The foregoing statements go to show that different conditions in the milk and even slight changes in operating the separator, without changing the cream-screw, cause the greatest variations in the percentage of fat in the cream.

1078—**The Revival of the Ensilage Question.**—BURRI, R., in *Annuaire agricole de la Suisse*, Year XVIII, Pt. 1, pp. 9-14. Berne, 1917.

The preparation of compressed fodder, or sweet silage, has been known for some time in Switzerland, but, recently a newly-awakened interest is being taken in it. This method of preserving fodder is only in general use in the United States, where it is employed chiefly for maize.

The introduction of this procedure into Swiss agriculture presents a problem which must be considered from various aspects: 1) scientific; 2) technical; 3) agricultural; 4) economical. These four aspects are considered in their most important details.

1) *Scientific* : — The conditions involving the minimum loss in food value; the bacterial action; the influence of the degree of moisture on the fodder to be preserved;

2) *Technical* : — The most satisfactory and most economical installation of silos; the most practical use of existing buildings and of those to be erected;

3) *Agricultural* : — Labour; the influence of silage on the quality of the milk; the consideration of the results obtained by advocates of the new method;

4) *Economical* : — The influence of silage on the general health and breeding capacity of the animals; the eventual detrimental influence on the quality of the milk, either from a hygienic point of view as a food for children and sick people, or from the point of view of manufacture, especially for exportation.



Only after the most important of these questions have been favourably solved can silage be prepared extensively. Of these questions two stand out and should be given precedence over the others. They are :

1) Would the introduction of silage, under the desired practical and scientific conditions, be of great economic advantage ?

2) Is the milk obtained from byres where silage is fed throughout the winter suited to the manufacture of cheese, or would it increase the difficulties of manufacturing a uniform and first class product ?

The second question, at least, has not yet been solved, and, considering the importance of the exportation of cheese in Switzerland, demands a thorough and comprehensive study.

The Swiss Agricultural Experiment Stations and Schools of Agriculture to which are attached farms, should all help to solve the problems arising from the introduction of silage ; nevertheless, the conditions under which such institutions work are not identical with those found on farms. It is, therefore, the results obtained by the many farmers who have adopted this method under varying conditions which will really permit of a solution of this problem. Experience only will solve the two chief questions, the financial value of the silage, and the value of the milk produced for the manufacture of cheese. Cheese factories using milk obtained from estates using silage should be under the scientific control of the Federal Establishment for the Milk Industry, and, eventually, also under the control of the county dairy stations. The cheeses made should, whenever desired, be thoroughly examined by representatives of the cheese trade and of the milk producers.

1079 - **Chemical Changes Observed in Silage in the United States.** — I. DOX, A. W. and PLAISANCE, G. P. (Chemical Section, Iowa Agricultural Experiment Station), in *The Journal of the American Chemical Society*, Vol. XXXIX, No. 9, pp. 2078-2087. Easton, Pa., September 1917. — II. PLAISANCE, G. P. (Id.). *Ibid.*, pp. 2087-2088.

In preceding publications (1) it was pointed out that the fundamental chemical changes to which silage owes its keeping properties consist in the conversion of the sugar present in the juice of the fresh plant into acids which inhibit the growth of putrefactive bacteria, and into carbon dioxide which expels the atmospheric oxygen and prevents the growth of mould.

In the continuation of their investigation on the fermentation phenomena that occur during the first 2 or 3 weeks after maize is put into the silo and on the products resulting from this fermentation, the writers have attempted to account, in part at least, for the soluble sugar which disappears, but cannot be recovered in the form of volatile acid, lactic acid, carbon dioxide and alcohol. The writers have proved that mannitol is a normal constituent of maize silage, as it is in silage made from other plants containing saccharose. Cane silage and sunflower silage contain manni-

(1) *Iowa Agricultural Experiment Station Bulletin* Nos. 7, 10, 16.

(Ed)

tol in much larger quantities. Mannitol is formed during the fermentation of ensilage by the bacterial reduction of the fructose-half of the saccharose molecule (1). It is produced in considerable quantity (to subsequently disappear to a certain extent) at the same time as the above-mentioned characteristic constituents of silage (acetic and lactic acid, carbon dioxide and alcohol). Its presence accounts in large measure for the deficit noted when the sum of these products is balanced with the fermented sugar. The writers then speak of the possible industrial utilisation of the mannitol thus produced, especially for explosives. It yields a nitration product very similar in properties to nitroglycerin. The average mannitol content of 8 samples of maize silage was 1.88 per cent. on the dry basis and the experimental extraction of silage gave about 0.5 per cent. of mannitol.

In these experiments, no trace of mannitol could be found in sweet clover silage. Unlike other leguminous plants, sweet clover (*Melilotus alba*) can be ensiled without the addition of other plants to supply fermentable sugar (sweet clover silage is, however, at present little known). On the other hand, in the samples of sweet clover silage examined, the amount of leucine recovered ranged from 0.4 to 1.0 per cent. of the dry material. Leucine has not been recovered from any sample of maize silage and, as far as is known to the writer of the second paper analysed, its occurrence in silage has not been reported by any previous investigators.

1080 — **Live Stock Market Review in the United States for 1916.**—NELSON, W. L., in *Missouri State Board of Agriculture, Monthly Bulletin*, Vol. XV, No. V, pp. 1-24. Columbia, Mo., May 1917.

The year 1916 in the live stock world was a very unusual one. The European war continued as a far reaching influence in the matter of prices. It is estimated that the exports of meats and meat products from the United States were worth about 275 million dollars. While smaller in volume the value was about 16 million dollars more, due to higher prices. A market paper places the exports of beef and beef products at about 370 million, pounds against 521.2 in 1915. The exports of pork and pork products, according to the same authority, were about 1500 million pounds against 1429 in 1915.

Bacon exports are figured at 565 million pounds against 522.4 in 1915; ham and shoulder exports, 285 million pounds against 266.4 in 1915; lard, 420 million pounds against 451 in 1915. Mutton exports are said to have been about 5 million pounds against 4.2 in 1915. These are unofficial figures.

Due to the European demand for meat, a record price level of values for live stock was recorded in the United States.

These records were made, notwithstanding the fact that almost 40 million head of meat animals were handled at the five leading western markets — Kansas City, Chicago, Omaha, St. Louis and St. Joseph. Cattle receipts at these markets were 7 984 473; hogs, 20 539 142; sheep, 10 695 271. At

(2) See R. July, 1917, No. 650.

(Ed.)



Kansas City 1916 top prices on the open market were: Steers, \$12; feeders, \$9.40; cows, \$8.75; heifers, \$11; calves, \$11.25; hogs, \$11.25; sheep, \$11.35; spring lambs, \$17 per hundredweight.

At this same market the average of monthly top prices shows: cattle, \$10.53; hogs, \$10; sheep, \$9.82; lambs, \$12.05.

Some of the high records made on the St. Louis market for the year 1916 were: native yearlings, \$12.75; native heavy steers, \$12.60; native yearling heifers, \$9.85; native mixed steers and heifers, \$11.15; December lambs, \$13.55; sheep, \$9.25; hogs, \$11.50; veal calves, \$12.25 per hundredweight.

During the year 1916 many notable sales of cattle were made in Missouri, one of the leading live stock states.

The following figures serve to show the high quality of Missouri live stock. Six hundred and seventy-five Shorthorns averaged \$479 per head; 1016 Herefords, \$497; 147 Angus, \$253; 58 Jerseys, \$337; 1838 Shorthorn, Angus and Hereford, \$470 per head.

One new law of 1917 is of very great importance to the live stock grower and feeder — the "commercial feeding stuffs label and inspection law" requiring a tag showing feeding value on each bag, package or bulk sale.

The following is a summary of returns as made by county assessors, showing number of live stock of various classes in Missouri on June 1, 1916:

Horses . . . . .	836 111
Mules . . . . .	353 853
Asses and jennets. . . . .	11 511
Cattle . . . . .	2 185 587
Sheep . . . . .	536 750
Hogs . . . . .	1 651 610
All other live stock . . . . .	48 465

Cattle on June 1, 1915 numbered 1 879 729 head.

1081 — **The Texas Turkey Trade.** — *Ice and Cold Storage*, Vol. XX, No. 226, p. 6. London, January 1917.

The *National Provisioner* publishes a long article by Mr. W. D. HORN-ADAY on the trade in turkeys in Texas which, thanks to cold storage and refrigerator cars, has become one of the most prosperous industries of that State. It is estimated that the packing-house crop of turkeys amounted in 1917 to 1 800 000 birds, a substantial increase over the yield in 1916. Turkey rearing has much increased in the cotton growing region, and the farmers regard their flocks of turkeys as of as much importance as their hogs.

The market is no longer localised, but prices are regulated by a nation-wide supply and demand.

The demand for turkeys is no longer limited to certain seasons; these birds are rapidly becoming a staple food product, and are in considerable request throughout the year.



The slaughtering and marketing season of turkeys begins usually the first week in November and ends on January 1st. The dressed fowls are stored by hundreds of thousands in refrigerating plants all over the country, and pass into the hands of retailers as the demand occurs. During the last season, there were probably more than 800 cars of dressed turkeys sent to the different markets of the United States, exclusive of the number the local markets required. Each car contained an average of about 100 barrels of turkeys, each holding about 22 birds. The average weight of each turkey when dressed was about 10 pounds. Thus the turkey crop which was marketed in car-lots amounted to about 1 760 000 fowls with an aggregate weight of 17 600 000 pounds. It is estimated that the farmers of Texas received at least £ 500 000 for that part of their last seasons' crop sent to distant markets. The total value of the turkey crop in 1915 was not less than £ 1 000 000. In Oklahoma, Kansas, New Mexico, Arizona, and California, the farmers are going into the industry on an extensive scale.

In order to prepare turkeys for the market, a large number of abattoirs and packing plants have been built in Texas during the last few years, and throughout the busy season they are working night and day. The large packers buy practically all the turkeys from the local merchants of the surrounding country and the shipment of live turkeys to the different plants is usually made by express or fast freight. The prices are quoted each morning. In many instances flocks of from a hundred to several thousand turkeys are driven overland for 30 miles or more to the nearest market. When they arrive at the packing plant, the turkeys are quickly killed and dressed. The packing plants each handle 2000 to 7000 turkeys per day. The birds are killed by piercing the brain with a needle which, it is claimed, is a painless process. The tail and wing feathers are put aside for the manufacture of feather dusters, and the body feathers are used for filling mattresses and beds.

The dressed turkeys were not only marketed in quantities last season in all the large towns of the United States, but were also sent to Canada and the North-West.

## PLANT DISEASES

### GENERAL INFORMATION.

LEGISLATIVE  
AND  
ADMINISTRATIVE  
MEASURES  
FOR THE  
PROTECTION  
OF CROPS

1082 - **An Act to Eradicate *Eichornia crassipes*, a Troublesome Weed in Burma, India (1).** — *The Agricultural Journal of India*, Vol. XII, Part 2, pp. 333-335. Calcutta, 1917.

*Eichornia crassipes* Solms (Water hyacinth), belonging to the family Pontederiaceae, has become a very serious pest in parts of India, especially Burma. In the former province, the weed is so wide-spread, that it has been found necessary to legislate against it, and the Water Hyacinth Act, No. 1, 1917, providing for the destruction of the plant, and all its parts, has been passed in the Local Legislative Council.

This Act declares *Eichornia crassipes* to be a public nuisance in Burma ; its provisions are as follows:

No person shall possess or keep the water hyacinth, and every owner or occupier shall destroy any water hyacinth growing in or on any place belonging to or occupied by him. Any person, who is duly authorised, may serve a notice on the owner or occupier of any place to destroy the water hyacinth growing thereon. Should such an owner or occupier fail to comply with this notice, the authorised person may enter upon such place and take all the measures necessary for the destruction of the water hyacinth, without being liable for trespass, or for injury to crops, pasture or fishery rights; any person who possesses or keeps the water hyacinth, or fails to destroy it in accordance with the terms of this notice, is liable to a fine not exceeding one hundred rupees, or upon a second or subsequent conviction, to a fine not exceeding Rs. 500. The local Government may make rules for the purpose of carrying out the provisions of this Act. Further, with the sanction of the Governor-General in Council, the Local Government may apply all or any of the provisions of this Act to any weed or plant, or to the seed or any part of such weed or plant which in its opinion is noxious.

(1) See also, B. May 1911, No. 1390 ; B. August 1912, No. 1167 ; B. April 1913, No. 333 ; B. August 1914, No. 798 ; B. June 1915, No. 660 ; R. September 1917, No. 798. (Ed.)

DISEASES NOT DUE TO PARASITES  
OR OF UNKNOWN ORIGIN.

## 1083 - Investigations on the Dying-out of Pepper-Vines in the Dutch-East-Indies. —

RUTGERS, A. A. L., in *Mededeelingen van het Laboratorium voor Plantenziekten* No. 27  
+ illustrations. Batavia 1917.

In a earlier report (1916), the author has given a description of pepper-cultivation at Banka. In this contribution are given the results of investigations on pepper-cultivation in the residency of Lampong districts situated in the far eastern part of Sumatra. Pepper has been the chief crop of Lampong (Sumatra) for centuries. It is cultivated now in the same parts of the Residency of the Lampongs as two hundred years ago. Half of the pepper produce of the Dutch-East-Indies comes from this Residency (about 12 million kg.).

Complaints are periodically heard about a decrease of pepper cultivation; these are especially frequent when many vines are dying owing to drought in times of high prices.

The last 50 years the prices of Lampong-pepper went down four times to 10 guilders and even less per pikol (60 kg.) and went up four times to 30 guilders, twice even to 40 guilders per pikol.

Three varieties are planted in Lampong: "lada boelak", "lada djambi" and "lada belantoeng".

Pepper cultivation in the Dutch East Indies has two distinct forms. On the one hand, the cultivation is that practised for many centuries by the Malay in Sumatra, a form of agriculture based on exhausting the virgin soil and leaving it alone afterwards; on the other hand the cultivation, is as practised by the Chinese, a refined form of horticulture. Pepper-cultivation in Lampong is of the first mentioned type.

The production of the vines averages about 1 ½ lb. black pepper a year, the vines lasting for about 15 to 20 years.

Nematodes do not cause any disease. Nematodes are to be found everywhere in the roots, but they are practically harmless. Roots of 159 vines, for the greater part very fine ones, have been examined: in 150 Nematodes have been found; only in 9 these seemed not to be present.

Root-fungus is present in rare cases.

The stem-disease from Malang (Java) has not been found in the Lampong districts.

Probably the fungus-threads in the vessels are quite harmless. Closer investigation is needed to make this point sure. Out of 149 vines the fungus has been found in 40.

Stem-borers and fruit-eating weevils are of minor importance in the Lampongs.

A pepper plantation is to be considered as dying out prematurely when the vines die before they are 15 years old, the symptom being usually a



gradual defoliation. Sometimes a plantation gets worse rather suddenly as a result of special circumstances (drought, heavy crop).

Premature dying-out cannot be explained by the action of parasites (nematodes, fungi, borers). The reason has to be looked for in the general state of cultivation of the pepper.

From the different diseases of dadap (*Erythrina*) only the stem-borers (*Batocera*) and the top-borers (*Terastia*) are locally important. These pests can be controlled by catching the *Batocera* or cutting out the larvae and by pruning the trees after the Lampong fashion, provided all cuttings are burned.

Dying out prematurely has been found only in the western and southern part of Lampong, where really good pepper soil is scarce now. Especially in well populated districts (Kalianda, Wai Lima) pepper is now being planted on soils which are not first rate and which have been planted with pepper before. At Tandjong Karang and in the Wai Lima district the difficulty to get suitable land for pepper is caused primarily by the number and extension of European estates. In the Wai Lima district 20 villages over a distance of nearly 20 miles have only at their disposition a strip of land from 1 to 3 km. deep. This must be insufficient, so that pepper cultivation in the Lampongs can be compared with tobacco cultivation in Deli as regards its want of land.

The pepper cultivation of Chinese and Bankanese at Banka shows that splendid pepper-vines are possible on soils where pepper is regularly dying out before 10 years old, provided tillage, manuring and other measures are closely attended to.

In British India the conclusion has been the same: when there is no virgin soil left, pepper cannot survive as a crop unless properly cultivated, and well manured.

## DISEASES DUE TO FUNGI, BACTERIA AND OTHER LOWER PLANTS.

GENERAL

1084 - **Fungi, Insects and Animals Injurious to Cultivated Plants, Observed in Denmark in 1916.** — LIND, J., ROSTRUP, S., and KÖLPIN, R. F., in *Tidskrift for Planteavl*, Vol. 24, Pt. 2, pp. 229-254. Copenhagen, 1917.

The annual report for 1916 of the Plant Pathology Station of Denmark records the following plant and animal pests:

**WHEAT.** — *Tilletia Caries* ("Hvedens Stinkbrand") has been reported all over the country; on an estate near Kögen, 75 % of the ears were attacked; *Puccinia glumarum* ("Hvedens gulrost") did much damage to the "Tystofte Standhvede", "Svalöfs Solhvele", "Grenadier" and "Extra Squarehead" varieties, whereas "Tystofte Smaahvede" and "Wilhelmina Hvede" were almost immune; *Leptosphaeria herpotrichoides* ("Hvedens Fodsyge") was active in the low districts, its development being favoured by the damp, cold spring.

**RYE.** — *Urocystis occulta* ("Stengelbrand"); *Puccinia graminis* ("Sortrust"), in the districts of Askov, Lyngby and Orholm; *Claviceps purpurea* ("Meldröjer"); *Leptosphaeria her-*

*potrichoides* ("Rugens Halmbræckersvamp"), common in soils rich in phosphorus (Himmerland, Holstebroegnen, Herningegnen).

**BARLEY.** — *Pleospora graminea* ("Stribesyge"), the attacks of which vary in intensity according to the variety; whereas, with "Prinzesse", only 1 to 2% of the plants were attacked, in other kinds the percentage rose to 20 to 40%; this was the case with the Danish barley, "Karl", "Abel-Juli", "Nordslesvigsk Kaempe", six-rowed "Tystofte" and "Erh. Frederiksens Krydsnings"; *Ustilago nuda* ("Bygbrand") attacked 20% of the ears on an estate near Skive; *Puccinia anomala* ("Bygrust"); *Erysiphe graminis* ("Meldug") and *Leptosphaeria herpotrichoides* at Fyn and at Lolland-Falster.

**OATS.** — *Septoria Avenae* ("Mörkpletsyge"); *Ustilago Avenae* ("Havrebrand") at Ask, Brædstrup, Skelskør; *Ust. Kollerii* ("Daekket Havrebrand") on a sample of "Graa Havre" (grey oats) from the Faroe Islands; *Heterodera schachtii* var. *avenae* ("Havre aales") appeared in the islands towards the second half of May, and during June and July spread also to Jylland, where it caused great damage, not only to oats, but also to barley and wheat.

The presence of larvae, which, towards the end of spring or during summer, usually do more or less damage to cereals in Denmark, was also reported: *Hylemyia coarctata* ("Kornets Blomsterflue"); *Oscinis frit* ("Fritflue"), *Chlorops taeniopus* ("Bygflue"); *Hadena secalis* ("Hvidaksregler"); *Tortrix falcana* ("Timothe-Vikleren"). In certain districts of Lolland-Falster, much harm was done to the wheat by *Contarinia tritici* and *C. aurantiaca*; less severe damage was also caused by *Siphonophora cerealis* ("Kornlus"); *Aphis avenae* ("Havrelus"); *Limothrips denticornis* ("Rug-Blaerefoden"); *Anthothrips aculeata* ("Aks-Blaerefoden") and *Thrips cerealium* ("Korn-Blaerefoden").

The appearance of larvae of *Bibio hortulanus* ("Have-Haarmyggen") was reported for the first time in Denmark at Mullerup, near Ullerslev.

**MANGOLDS AND SUGAR BEETS.** — *Phythium De Baryanum* ("Rodbrand"), and, in many districts, including the islands and Jylland, "mosaic disease"

Among the harmful larvae, the report mentions those of *Snipha opaca* ("Aadsebillen"), *Anthomyia conformis* ("Bedeflue") and *Hydroecia micacea*, observed near Korinth at the beginning of June; *Aphis papaveris* ("Bedelus") effectively suppressed with tobacco extract.

**KOHLRABI AND TURNIPS.** — *Phoma Napobrassicæ* ("Kaalroernes Tørfovreådneelse"); *Pseudomonas campestris* ("Brunbakteriose"); *Bacillus carotovorus* ("Hvidbakteriose"); *Alternaria Brassicæ* ("Skulpesvamp"); *Plasmodiophora Brassicæ* ("Kaalbroksvamp") in districts where this parasite was previously unknown; near Krogerup in Stevns and near Lundby in Lydsjælland; *Cylindrosporium Brassicæ* was reported in the Holstebro district; it caused necrosis on leaves of *Brassica* spp., and had previously been found neither in Denmark nor the neighbouring countries; more or less serious damage was also caused by larvae of *Ceuthorrhynchus quadridens* ("Bladrippe Snudebillen") by *Aphis brassicæ* ("Kaallus"), *Meligethes acneus* ("Glimmerbøssen"); *Ceuthorrhynchus assimilis* ("Skulpe Snuderbillen"); *Phyllotreta nemorum* and *Ph. atra* "Jordlopperne"; almost entirely absent: — *Pieris brassicæ*, *P. rapæ*, *Plutella crucifera* ("Kaalmaal") and *Eurydema oleracea*.

**POTATOES.** — *Phytophthora infestans* ("Kartoffelskimmel") ; *Bacillus phytophthorus* ("Sörteben") in Jylland and the Faroe Islands; *Spongospora subterranea* ("Pulverskurv"), near Holstebro and in the Faroe Islands; *Cercospora concors* near Studsgaard and Birkebaek, on leaves while still green; *Myzoides persicæ* (?) ("Kartoffellus"), near Aarhus and Lyngby, on the flowers.

**CLOVER.** — *Sclerotinia Trifoliorum* ("Klöverens Baegersvamp"); among the insects the larvae of *Phytonomus nigrirostris* ("Klövergnaveren"); *Sitona lineola* ("Bladradbillen") and *Siphonophora pisi* ("Bladlus"); as usual, great damage was caused by *Tylenchus devastatrix*.

**LUCERNE.** — *Phythium De Baryanum* ("Rodbrand"), at Viborg and Grenaa; *Sclerotinia Trifoliorum*; among the insects: larvae of *Phytonomus variabilis* ("Lucernegnaveren") at Lolland-Falster and Næstved; these, however, were attacked and killed in large numbers by



*Entomophthora Phyttonomi*; *Cucorhinus exaratus* ("Snudebille"), observed in lucerne fields near the Studsgaard Experimental Station.

**FORAGE CROPS.**—*Nectria graminicola* ("Sneskimmel"); *Epichloe typhina* ("Snedesvamp"); *Ustilago perennans* ("Draphavrebrand"); *U. bromivora* ("Heinebrand"); *Aplanobacter Rathi* ("Hundegraesbakteriose"); *Uromyces Poae* ("Rapgraesrust"); *Puccinia Arrhenatheri* ("Draphaverust"); the appearance of the larvae of *Cleigastra flavipes* ("Timothethuen"), was reported in June near Lyngby, and, on July 16, in the same district, large numbers of *Forficula auricularia* ("Orentviste") were seen in the fields of Timothy grass.

Some animal pests, instead of confining themselves to one specified plant or group of plants, attack and injure many crops or all crops in general. They may be divided into four groups: 1) insect larvae; 2) gasteropods; 3) birds; 4) rodents.

The larvae of *Agrotis segetum*, of *A. tritici* ("Hvedeuglen"), of *Agriotes lineatus* ("Smelder"), damaged cereals, vegetables, beets, etc. in many districts, both in the peninsula and in the islands. Numerous larvae of *Melolontha vulgaris* ("Oldenborre") were reported near Aarhus, at Lolland-Falster and in the district of Vordingborg; in many places (Grindsted, Kolding, Herning) the oats, wheat and rye suffered from attacks of *Tipula paludosa*, the larvae of which greedily devour the green part of the young plants.

Owing to the damp, cold season *Agriolimax agrestis* ("Agersneglen") spread everywhere and damaged the cabbages and forage plants (Gramineae and Leguminosae), and also caused considerable loss in the beet, carrot (Lyngby) and potato (Aarhus) fields.

*Corvus frugilegus* ("Raager") completely destroyed a maize field near Sorø; *Columba oenas* caused damage to the barley fields at Lyngby; and, finally, *Passer domesticus* ("Spurve") did damage to kitchen gardens and seed-plots.

*Arvicola agrestis* ("Markmus") injured winter cereals in the Løgstør district and potatoes in the Salling district. *Mus decumanus* ("Rotter") attacked barley in the Faroe Islands; *Talpa europaea* ("Muldvarpen") and *Lepus europaeus* ("Hare") did damage here and there to meadows, oats, barley and root-crops.

The methods of control, used against the fungoid parasites and the animal pests of the various crops, are described.

1085 — **Nigerian Fungi** (1). — WAKEFIELD, E. M., in *Royal Botanic Gardens, Kew, Bulletin of Miscellaneous Information*, No. 3, pp. 105-111. London, 1917.

This paper gives a list of 38 fungi collected by Mr. C. O. FARQUHARSON in South Nigeria during the period 1914-1916. Six species are new to science.

The only fungus in the list known to be of economic importance is the pyrenomycete *Ustilina zonata* (Lév.) Sacc., recognised in 1914 as the cause of a distinct disease of *Hevea brasiliensis* at Calabar.

The same parasite has long been reported on the same plant host in the Federated Malay States (2).

1086 — **Soil Fungi Injurious to Cultivated Plants in the New York Botanical Gardens.**

—SEEVER, F. J., in *Journal of the New York Botanical Gardens*, Vol. XVIII, No. 212, pp. 186-188. Lancaster, Pa., 1917.

A considerable amount of damage has been noted recently among various plants of the New York Botanical Garden, and this injury has

(1) See also *B. Sept.*, 1913, No. 1107. — (2) See *B. Sept.*, 1915, No. 981 and *R.* July, 1916, No. 812.

*U. zonata* has since been reported on *Hevea* in the island of Sumatra. Cf. *R.* Nov., 1916, No. 1234. (Ed.)



apparently been caused by the presence of fungi which normally inhabit the humus of the soil.

The attention of the writer has especially been called to a bed of *Funkias* in which about one-third of the foliage was dead. The examination of the leaves of these plants, while showing slight traces of fungus mycelium and spores, as is usual on dead plant tissues, did not reveal any particular species present in sufficient abundance to account for the death of the plants. A careful examination of the soil about the bases of these plants, however, showed the presence of a fungus belonging to the genus *Sclerotium* which had apparently attacked the plants through the medium of the soil. The fungus appeared to be *Sclerotium Semen* Tode, a species which commonly occurs on dead leaves and in the humus of the soil.

The writer also observed on tulip bulbs the presence of *Scl. Tulipae* Therry, which appeared to be accountable for the failure to bloom of the plants produced from such bulbs. There is reason to suspect that the origin of infection is the same in both cases.

Still another fungus which has ordinarily passed as a saprophyte has been found to attack the root-stocks of the wild geranium, causing their decay. Laboratory experiments have been carried out in order to determine the life history and habits of the latter species, and the results of these experiments will shortly be published.

1087 - Over-Wintering of the Apple-Scab Fungus, *Venturia inequalis*, in Canada (1). — FRASER, W. P., in *Science, New Series*, Vol. XLVI, No. 1186, pp. 280-282. Lancaster, Pa., 1917.

Though it is generally known that the scab disease of the apple caused by the fungus *Venturia inequalis* sometimes attacks the young twigs of susceptible varieties of the apple, yet not much has been published on this phase of the disease in North America.

MORSE and DARROWS have shown that the conidia of this fungus survived the winter on apple twigs and germinated readily in the spring. They found no evidence, however, that the mycelium exists during the winter as a living stroma and produces conidia in the spring. WALLACE also reviews the literature on the persistence of the stroma on the twigs and the hibernation of the conidia, and is convinced that twig infection is not of common occurrence, and that the conidia cannot withstand winter temperatures.

The writer's attention was first called to scab disease on the young shoots of the apple in the autumn of 1915, when a number of badly diseased twigs of a McIntosh apple tree were sent for determination by Dr. E. W. HENDERSON, of Masonville (Quebec). The twigs were defoliated for several inches from the tips and the leaves that remained below showed a very severe attack of scab. The twigs were severely injured, many of them being in a dying condition. The bark was studded with the pustules of the scab disease

(1) See also *B.* March 1911, Nos. 1021-1024; *B.* June 1911, No. 1898; *B.* April 1913, No. 234; *B.* June 1913, No. 756; *B.* October 1913, No. 1210; *B.* October 1914, No. 959; *B.* February 1915, No. 183; *B.* December 1915, No. 1350; *R.* May 1916, No. 577. (Ed.).

and abundant conidia were present. Another collection was sent by Dr. HENDERSON a few weeks later, but many of the twigs were now dead and few conidia remained.

Another collection of diseased twigs was received about April 1, from Prof. SHAW, collected at Truro Agricultural College N. S., also from a McIntosh tree. Many of these twigs were killed back several inches, while abundant pustules of the scab were present in both dead and living bark.

The affected twigs showed the characteristics described by MORSE and DARROWS. The bark was more or less thickly studded with light brown spots which examination showed to be blister-like areas due to the death and pushing out of the epidermis of the twigs. Many of these light-brown areas were roundish, or oval, with a dark centre. A number, however, lacked the dark central area. Pieces of the diseased bark were removed, embedded in paraffin, and sectioned, and the sections and diseased twigs examined. A well developed stroma was present, with many conidia beneath the raised epidermis. The dark centre was composed chiefly of the conidiophores of the fungus, the exposed conidia having fallen away.

Dr. HENDERSON and Prof. SHAW were asked to forward diseased twigs collected about blossoming time. The collection from Prof. SHAW was received about June 1st. A few inches of the tips of some of the twigs were dead, but the bark of the living parts and of the living twigs contained many scattered pustules of the apple-scab actively producing conidia, the pustules being olive-green from the abundant conidia. The dead parts of three twigs were thickly covered with scab pustules from the previous season, but the stroma were dead, or not producing conidia.

Fresh conidia, placed in hanging drops of distilled water, germinated as freely and vigorously as conidia obtained a short time later from the young leaves of an apple in the orchard. Pieces of the bark containing live pustules were fixed, embedded in paraffin, and sectioned. The stroma was very well developed, reaching a maximum thickness of 200  $\mu$ , while the maximum thickness of the stroma on the fruit was about 55  $\mu$ . It was also evident that the stroma was actively producing conidia at the time of fixation.

In 1915, Mr. A. G. TURNEY described the scab as being troublesome in the twigs of susceptible varieties, and states that in one orchard all the twigs of the previous year's growth of the Fameuse were covered with scab spots. He also found the amount of scab on the fruit was much reduced by trimming off the diseased twigs early in the spring. He had previously failed to control scab in this orchard by spraying. Mr. TURNEY states, in a letter to the writer, that the scab is quite common in the coastal regions as a twig infestation, and it may be found also in almost any orchard inland, but rarely so bad as to be a serious hindrance to growth.

Prof. SHAW has informed the writer that he found severe twig injury from scab in several different regions in Nova Scotia. The twigs collected at Mansonville, Quebec, at blossoming time by Dr. HENDERSON did not show any living pustules, but as few of them had been cut back into the living wood, the negative evidence was not satisfactory.

The twigs that had been received from Truro, N. S. about April 1st.



were left about 8 weeks in the laboratory under ordinary conditions. Conidia were then taken from the scabbed areas and were tested in hanging drops of distilled water for germination. A small percentage was found to germinate. A second test gave the same result. The spores were taken from beneath the blistered bark, so that they had a certain amount of protection from the cold and from drying.

The writer is convinced from these experiments and observations that, in certain regions near the coast, apple scab may winter on the twigs of susceptible varieties such as "Fameuse" and McIntosh as a dormant stroma and produce abundant conidia in the spring. He also confirms MORSE and DARROW's conclusion that, under certain conditions, and with certain varieties of apple, diseased twigs and rain may be an important factor in the propagation and spread of the disease.

J. S. DASH, who has devoted some time at Quebec to the study of apple scab, collected scabby apples early in the spring that had lain under the snow all the winter, and found that about 5 to 10 per cent. of the conidia germinated.

On November 27, 1916, the writer collected scabby apples that had remained under the trees after their fall without protection of any kind. During late autumn, and early winter, the temperature fell below the freezing point 15 times, rising above it during the day.

There were 2 periods of severe frost followed by mild weather, the minimum temperature of the first being 11° F., and of the second (November 26) being 1° F. Conidia were abundant on the scab spots and these were placed in hanging drops of distilled water. The spores germinated vigorously and freely, and in 24 hours showed many germ tubes over 100  $\mu$  in length.

More than 26 per cent. of the conidia placed in hanging drops of distilled water germinated. Only those with well-developed germ-tubes were counted. There could be no doubt whatever that the germ tubes had developed while in the water.

It would seem from these observations, that the conidia are more resistant to low temperatures than is generally supposed. The writer hopes to carry on further experiments along this line during the winter and spring.

1088 - **The Presence of Nitrites and Ammonia in Diseased Plants.** — See No. 1009 of this *Review*.

1089 - **Hypothesis to explain the Resistance of Wheat to Rust.** — See No. 1010 of this *Review*.

RESISTANT  
PLANTS

1090 - **Resistance of Hybrid Direct Bearers to Diseases.** — See No. 721, *R.* August 1917 and No. 1026 of this *Review*.

1091 - **Patents for the Control of Diseases and Pests of Plants.** — See No. 1059 of this *Review*.

MEANS.  
OF PREVENTION  
AND CONTROL



1092 - **Fungous Diseases of Wheat in the Argentine.** — See No. 1016 of this Review.

1093 - ***Aplanobacter Rathayi* Injurious to *Dactylis glomerata* in Denmark.**

— LIND, J., in *Tidskrift for Planteavl*, Vol. 24, Pt. 2, pp. 255-263. Copenhagen, 1917.

*Aplanobacter Rathayi*, studied and described for the first time by EMMERICK RATHAY, who discovered it on infected plants in a wood near Vienna (1897-1899), causes bacteriosis of *Dactylis glomerata* L. (Cocksfoot). In 1912, after having occurred here and there to a limited extent, it suddenly spread with marked virulence through various districts of Denmark. These attacks were repeated with great frequency and intensity the following years. The gelatinous masses of bacteria adhere to the panicles of *Dactylis*, thus preventing its proper development. During rain they are dissolved and flow down the leaves and culms, even infecting neighbouring plants. The Author studied the disease from 1912 to 1916 and came to the following conclusions:

1) The bacteriosis is introduced and spread by infected caryopses. If the seed from fields infected with *Aplanobacter* be examined, caryopses are often found completely filled with a small gelatinous mass, formed by the bacterium, which, under favourable conditions of moisture and temperature, develops with great rapidity ;

2) wind does not help to spread the disease. Healthy plants may be infected by direct contact with diseased specimens, especially during the rains ;

3) when infection has occurred the plant retains the bacteria for a long time ; thus, in the same soil, the epidemic persists from year to year with an intensity varying according to the meteorological factors ;

4) abundant nitrogenous manuring seems to attenuate the damage caused by *Aplanobacter* and to hinder its spreading ; but sufficient data are lacking to confirm this ;

5) the most efficacious method of controlling the disease is to use seed from immune districts.

1094 - ***Phytophthora Faberi*, the Cause of Hevea Canker.** — RUTGERS, A. A. L., in *Mededeelingen van het Laboratorium voor Plantenziekten*, No. 28, Illustrations. Batavia, 1917.

I. — The first paragraph gives the contents of the preliminary reports of 1912 and 1913 ; the former of which, treating of the form of canker known as "canker-patches", can be summarised as follows.

Hevea-canker has been found in Java, Sumatra and Borneo.

The systems of canker appear in the following order :

1) The disease is usually discovered by the cessation of the latex flow.

2) In the outer bark claret-coloured patches are to be seen, when the cork-layers of the bark are shaved off. In many cases these patches begin at the cuts and run downwards.

3) A discoloration sets in of the inner layers of the cortex which become greyish or slightly brown-coloured just outside the cambium. This

discoloration starts from the claret-coloured patches, but extends over a larger area and subsists after the disappearance of the patches.

4) Woody tissue is formed round the dead brown cells in the inner cortex, by the action of a secondary or wound cambium. This formation of wood in the cortex goes on for several months, perhaps for years after the canker-infection is over.

The measures advisable to get rid of the canker are the following :

1) The humidity of the plantation should be decreased and free access to air and sunlight provided ; for this purpose removing the inter-crops, thinning-out and pruning the trees, or draining, may be advisable according to circumstances.

2) Cut out thoroughly all diseased tissues of the cortex but leave the cambium undisturbed. Train a special gang of labourers for this work.

3) Disinfect the tap-knives by means of formalin and spray the stems with Bordeaux mixture. (Disinfection and spraying in this way are no longer used in Java).

The second report (1913), treats of " stripe-canker ", a form of canker unknown before.

This form of canker shows a decay of the renewing bark and is only to be found in the rainy season in very wet weather. The decay is first indicated by the appearance of vertical black lines just above the tapping cut. These black lines, very thin at first, soon become larger and fuse with the neighbouring ones. The whole of the renewing bark can decay in this way. Occasionally transition stages between this form of canker and the ordinary canker patches are found. The disease spreads exceptionally quickly ; the use of water on the tapping cuts must have been the cause. The damage was serious ; out of 10 000 8-year old trees, 6000 were so seriously diseased, that tapping had to be stopped.

The only curative measure was the application of Carbolineum Plantarium diluted with water. (It was used in 50 % strength at first, now 20 % is used, and probably a lower percentage, say 5 %, would do as well).

II. — A series of infection experiments has proved conclusively that both canker patches and stripe-canker are caused by *Phytophthora Faberi* Maubl.

The canker patches could be obtained artificially by putting some mycelium into an incision in the old bark, and stripe-canker by bringing a suspension of conidia in water on the newly opened tapping-cut. Controls were made with clean water.

In order to obtain canker patches six infection experiments with a total of 56 infections have been made ; 48 were successful. Of the infections made in the rainy season and protected against drying out, 100 % were successful ; the control cuts always remained free from infection.

As to stripe-canker, five experiments with a total of 76 infections have been made to prove definitively that this form of canker is caused by *Phytophthora* as well ; altogether 61 have been successful, the remaining ones being exposed to sunshine (in one case) or being made on tapping cuts that had not been opened for several days (in 14 cases). Provided the tapping



cuts were opened daily and were not exposed to sunshine the infections were successful without a single exception. The control cuts remained free of infection.

PETCH and BANCROFT have recorded stripe canker from Ceylon and F. M. S. as well. PETCH says the phenomenon is probably due to excessive moisture. The above mentioned experiments not only show that *Phytophthora* is the real cause, but the controls, where pure water was used, also prove that excessive moisture alone is not sufficient to cause the decay of the renewing bark.

III. — The progress of the disease was studied in detail on 33 cankered Hevea-trees in the experimental garden of the Laboratory for Agricultural Chemistry at Buitenzorg. The trees were under observation during two years. The red canker patches disappeared wholly during that period; the burrs, on the contrary, increased in number and size, or appeared on trees which were originally free from burrs and had only a canker patch. The other trees in the garden, where no symptoms of canker had been found, remained free from burrs.

Apart from this direct proof that burr-formation is a symptom of canker, further evidence is given by the fact that burred trees are to be found only on estates where canker has been prevalent, and that no new burred trees are added to the existing ones, when adequate measures against canker are adopted.

Treatment of a part of the above named trees lead to the following conclusion: under the favourable circumstances of the experimental garden light attacks recovered by themselves, provided tapping was stopped; severe attacks, when not treated, recovered only in exceptional cases, but by shaving all diseased bark, 5 out of 8 badly diseased trees recovered.

IV. — Comparison of pure cultures of six species of *Phytophthora* showed that morphologically *P. faberi* (from Cacao, Hevea and nutmeg), *P. Nicotianae* (from tobacco), *P. Colocasiae* (from *Colocasia*) and *P. Jatrophae* (from *Jatropha Curcas*) are distinct species, differing from each other by their *habitus* in pure culture and by the form and dimension of the conidia. *P. Fagi* and *P. Cactorum* are quite different from the four species mentioned. *P. Jatrophae*, *P. Fagi* and *P. Cactorum* formed oospores in pure culture; those of *P. Jatrophae* were not of the *Cactorum* type, but of the *infestans* type.

V. — The result of 390 infections with the six *Phytophthora* species on different hosts confirmed the result of the morphological investigation.

The *Phytophthoras* from Hevea, Cacao and nutmeg belong to the same species; only the line isolated from Cacao proved to be more virulent for Cacao and Hevea, and the one isolated from nutmeg more virulent for nutmeg.

Infections with each of the named species are only successful on its own host. With *P. Jatrophae* no successful inoculations were obtained, not even on "djarak" (*Jatropha Curcas*) from which it was isolated.

VI. — As to the treatment of canker, preventive measures are, and re



main, the most important ones ; first of all thinning out, next drainage and removal of intercrops. Pruning for the purpose is no longer practised.

The direct measures consist only in excision of the red canker patches and the dressing of the stripe-canker with Carbolineum Plantarium (20 % or less). Detection of the disease at an early stage is highly important. Diseased trees are not tapped.

When done thoroughly this treatment proved a complete success in most cases ; on some estates, where the climate favoured canker, this treatment is not sufficient ; new means of combating the disease are to be looked for, probably spraying with a fungicide ; also the fruit-rot should receive more attention.

VII. — Infection experiments with fruit rot are briefly discussed. *P. Faberi* alone can cause fruit rot, and even without a wound being previously made. During the experiments the disease spread in a most extraordinary way. When starting the experiments there was not one diseased fruit in the plantation ; after three weeks the experiments had to be stopped because locally 50 % of the fruits were attacked, many of them being quite covered with *Phytophthora* conidia. Small flies (*Drosophila*) seem to help a good deal in spreading the disease.

VIII. — Four different kinds of burrs in Hevea-bark are distinguished according to their origin :

1) Real peas in leaf-scars. These are not caused by dormant buds, as the connection with the pith is still intact and therefore the bud alive. Probably these are formed around the remainder of the vascular bundles of the petiole (BATESON), as has been demonstrated by HARTIG for the sphaeroblasts, which are formed in the leaf basis of fir-trees. These peas are rare and harmless.

2) Burrs, arising after the use of the pricker ; these are built concentrically around the scars made by the pricker. These become rarer every year and will soon disappear wholly.

3) Burrs as a result of canker ; these are very common and often of considerable dimensions. Nearly all the badly burred trees are of this type. The only remedy is to prevent or treat all canker-cases.

4) In some case the burrs are not secondary wood-formations in the cortex, but the central wood itself has an irregular surface not only on the stem but on the branches also. The cause is unknown. The trees are worthless and should be removed.

1995 — *Peronospora Radii*, a Parasite of Camomile, New to Italy.— BELOSERSKY, N., in *Atti dell'Accademia Veneto-Trentino-Istrianica*, Vol. X, pp. 111-116. Padua, 1917.

In May 1917, near Este (a district called "Dossi", in the parish of Ospedaletto Euganeo, province of Padua), Prof. A. BÉGUINOT collected several specimens of *Matricaria Chamomilla* L., with deformed heads, growing in the sand of an old bed of the Adige.

The ligulate flowers were the worst attacked, which made a strange effect, so that the first impression was that of a species differing from that ordinarily found. An examination of the purple matter covering the diseas-

ed parts speedily showed the presence of conidiophores and conidia of *Peronospora Radii* De Bary.

The symptoms of the disease are described, and it is pointed out that this *Peronospora*, found for the first time in Germany and already observed in Belgium, Austria, Finland, Switzerland and France on camomile and other Compositae, had never previously been reported in Italy. Venetia is one of the districts which have been most thoroughly studied from a mycological point of view and 13 species of *Peronospora* have been found there. It therefore seems that *P. Radii* must be new to the district.

1906 - ***Bacterium Pruni*, Injurious to Peach and Plum Trees in the United States.** —

ROBERTS, JOHN, W., in *United States Department of Agriculture, Bulletin* 543, pp. 1-7, 1 pl. Washington, D. C., 1917.

In most of the peach-growing sections of the eastern half of the United States (Massachusetts, Connecticut, New Jersey, Delaware, Maryland, Pennsylvania, Michigan, Illinois, Indiana, Ohio, Kentucky, Tennessee, Virginia, North and South Carolina, Georgia, Alabama, Arkansas, Missouri, Nebraska and Texas), and especially in the most southern ones, the disease commonly called peach bacterial spot, or peach bacteriosis, is becoming increasingly important.

The disease is caused by *Bacterium pruni* Erw. F. Smith, which attacks plum trees as well as peach trees.

The parasite attacks the leaves, fruit and twigs.

If there are a number of infections close together, they may coalesce, forming a rather large canker, with a somewhat abundant flow of gum. As far as the peach is concerned, the direct killing of the twigs and branches is rare and this phase of the disease is not in itself to be considered as very serious; the twig lesions are, however, of importance, for it is in these that the pathogenetic organism passes the winter.

On the fruits, minute spots first appear, these soon become enlarged; later, small cracks appear in the diseased areas, these extend and finally several run together, making long irregular fissures which render the fruit unfit for market. Orchards in which direct damage to fruit causes much loss are, however, rather rare.

The injury to the leaves is usually the most serious phase of the disease. Small, nearly transparent, areas occur on the leaves; later, these spots become dry and brittle, then as a final stage, they crack away from the living tissue and often fall out, giving the leaf the so-called shot-appearance, or else a peculiar ragged aspect. Sometimes the injury caused is so great, that the tree is partially, or even totally, defoliated.

Practically all peach varieties are attacked, at least to some extent, by this disease. The Elberta, the leading commercial peach, is very susceptible. It is very difficult to estimate the relative susceptibility of different varieties, but the Bilyew, Elberta, Carman, Champion, Oldmixon, Sneed and Waddell appear to be more susceptible than such varieties as the Hilly, Belle, Fox, Edgemont, Rivers, Early Crawford and Salway. *Bacterium pruni* especially attacks Japanese varieties of plum.

Experiments carried out by the writer, and others, indicate that this disease may be kept in check in southern peach orchards by proper pruning, cultivation, especially fertilisation. Nitrate of soda was by far the most efficient fertiliser used. Trees in which a high state of vigour and health is maintained are commercially resistant to the disease.

## INJURIOUS INSECTS AND OTHER LOWER ANIMALS.

1907 - **Animal Pests Observed During 1916 in Denmark.** — See No. 1084 of this Review.

GENERAL

1908 - **Undesirable Insects Which Have Recently Been Introduced into New Jersey United States.** — WEISS, HARRY, B., in *The Canadian Entomologist*, Vol. XLIX, No. 9, pp. 293-298. pl. XIV. London, 1917.

In order to show that ordinary phytopathological inspection on arrival is not sufficient to prevent plants coming from abroad being the means of introducing parasites destructive to the crops of a country, the writer mentions some recent cases which have occurred in New Jersey and have caused considerable loss to the farmers in that State.

He deals with a few of these cases in detail: *Gryllotalpa gryllotalpa* (the mole cricket) came to New Jersey in a rhododendron plant from Holland; *Blaberus discoidalis* (the large cockroach) was introduced with some wild orchids from South America; *Stephanitis pyrioides* came to New Jersey from Japan on an azalea; and *Cholus forbesii* was transported into that State on some orchids from the tropical forests of Colombia.

To remedy this state of affairs, the writer suggests the institution of a national quarantine of all foreign nursery stock.

1909 - **Observations on the Coccidae of Asia, Africa and America (1).** — NEWSTEAD ROBERT, in *Bulletin of Entomological Research*, Vol. VIII, Part. I. pp. 1-34, fig. 1-22 London, 1917.

A systematic description of:

1) *Llaveia abrahami* sp. nov., inhabiting indentations in the bark of *Sapium Jenmani* at Issororo, N. W. District (British Guiana); attended by ants which construct coverings over the Coccids;

2) *L. primitiva* var. *pimentae* var. nov., on *Pimenta officinalis* in Jamaica, attended by the "stinking-ant" (*Cremastogaster* sp.); not of great importance;

3) *Monophlebus* (?) *hirtus* Brain, Mt. Mlanje (Nyasaland);

4) *Aspidoproctus neavei* sp. nov., in the same locality on the "Mwange" tree;

(1) See also R. October 1917, No. 977.

(Ed.)



- 5) *A. verrucosus* sp. nov., on the trunk of a fig tree, Ngamba Is. Uganda ;
- 6) *Palaeococcus bicolor* sp. nov., on *Thespesia* sp.; Aburi (Gold Coast) ;
- 7) *P. caudatus* sp. nov., on crotons (*Codiaeum*) at Entebbe (Uganda) ;
- 8) *P. Cajani* sp. nov., on *Cajanus indicus*, at Agege (S. Nigeria) ;
- 9) *Icerya nigroareolata* sp. nov., on coffee at Kampala and on *Codiaeum* et Jinji (Uganda) ;
- 10) *I. sulfurea* var. *pattersoni* v. nov., on *Tectona* sp. at Aburi ;
- 11) *Margarodes buxtoni* sp. nov., at El Kantora (Algeria) ;
- 12) *Stictococcus gowdeyi* Newst., on young shoots of cacao, at Agege ; invariably protected by an ant (*Oecophylla*) ;
- 13) *St. intermedius* sp. nov., on cacao ; Aburi ;
- 14) *St. multispinosus* Newst., on stems of *Cajanus indicus* at Agege, and on *Markhamia platycalyx* at Kampala ;
- 15) *Asterolecanium spectabile* sp. nov., on palm trees in Botanic Gardens, Mauritius ;
- 16) *Lecaniodiaspis tarsalis* sp. nov., at Pretoria (Union of South Africa) ;
- 17) *Phenacoccus ballardi* sp. nov., on mango, at Coimbatore and on an unnamed plant in S. Kanara District (S. India) ;
- 18) *Tachardia bodkini* sp. nov., on *Sapium Jenmani* near Repos, Georgetown (British Guiana) ;
- 19) *Pulvinaria aristolochiae* sp. nov., on *Aristolochia* sp. at Aburi ;
- 20) *P. elongata* sp. nov., on blade of sugarcane at Georgetown ;
- 21) *P. (?) flavicans* Mask., on " blood-wood " plant at Rockstone (British Guiana) ;
- 22) *P. subterranea* sp. nov., on roots of *Chrysanthemums* at Entebbe ;
- 23) *P. africana* sp. nov., heavy infestation on guava, at Accra (Gold Coast) ; many examples of the scale-insect were attacked by a parasitic fungus and by the larvae of a predaceous lepidopteron ;
- 24) *Ceroplastes avicenniae* sp. nov., on *Avicennia nitida* at Mahaica Creek (British Guiana) ;
- 25) *C. bipartitus* sp. nov., in Union of S. Africa ;
- 26) *C. destructor* sp. nov. (*C. ceriferus* [Anderson] Newstead), in Uganda ;
- 27) *C. egbarum* Ckll., on *Pithecolobium saman* at Tamale (Gold Coast) ;
- 28) *C. lamborni* sp. nov., on cacao and on a climber on a bush tree at Ibadan (Southern Nigeria) ;
- 29) *C. subdenudatus* sp. nov., on *Acacia* sp. at Entebbe ;
- 30) *C. vuilleti* Marchal, abundant on *Cajanus indicus* at Agege and Ibadan ;
- 31) *C. zonatus* sp. nov., in Union of South Africa ;
- 32) *Inglisia theobromae* sp. nov., on stems of cacao pods and flowers, at Nagunga (Uganda).

1100 — **Coccidae of British Guiana.** — BODKIN, G. E., in *Bulletin of Entomological Research*, Vol. VIII, Part. I, pp. 103-109. London, 1917.

The present paper is supplementary to the one published in 1914 on the same subject (1).

It is necessary to mention the following scale-insects once more, as they have now been found upon different host plants from those recorded in the preceding paper:

*Howardia biclavus* Comst., fairly common on branches of *Jasmin* sp;

*Hemichionaspis minor* Mask., fairly common on *Asclepias* sp;

*Pseudococcus virgatus* Ckll., on some garden plants, such as *Viola*;

*Ceroplastes denudatus* Ckll., collected recently on a wild solanacea;

*Vinsonia stellifera* Westw., on orchids;

*Saissetia oleae* Bern., on *Codiaeum* spp;

The following species are recorded for the first time in the Colony:

• *Llaveia abrahami* Newst., a rare species, hitherto only found in an indentation of the bark of *Sapium jenmani*;

*Aspidiotus rapax* Comst., an uncommon species; up to the present only found on the twigs of the Oronoque tree (*Erythrina glauca*);

*Pseudonidia fossor* Newst., an uncommon species only once collected on the twigs and branches of a large Muscatel grape-vine in Georgetown;

*Chrysomphalus erythraspidis* Newst., a comparatively rare species; collected once in abundance on the twigs of *Erythrina glauca*;

*Pseudococcus sacchari* Ckll., common wherever sugar-cane is grown in British Guiana; most prevalent in dry weather;

*Tachardia bodkini* Newst., rare; on twigs of *Sapium Jenmani*;

*Pulvinaria flavicans* Mask. var *formicicola* Newst., an uncommon species collected from wild species of plant with a deep red sap;

*P. elongata* Newst., rare; collected on the leaf-blades of sugar-cane;

*Ceroplastes cirripediformis* Comst., an uncommon species occurring on *Ipomoea* sp. at Georgetown;

*C. avicenniae* Newst., an uncommon species, occurring solely on a maritime plant known locally as "Courida" (*Avicennia nitida*);

*Eucalymnatus chelonoides* Newst., rare; collected on leaves of *Pachira insignis* in Botanic Gardens, Georgetown;

*Euc. tessellatus* Sign., a common species on ornamental palms;

*Coccus aequalis* Newst., common in certain districts on *Avicennia nitida*;

*C. viridis* Green, a common species on *Coffea liberica* in some districts of considerable economic importance;

*C. wardi* Newst., a rare species from leaves of Malacca apple (*Eugenia malaccensis*), Georgetown;

*C. impar* Ckll., uncommon species; name of host plant unknown;

*Akermes quinquepori* Newst., rare species; from beneath the bark of certain trees, e. g. *Macrolobium acaciaefolium*, in Botanic Gardens, Georgetown;

*Saissetia hurae* Newst., a rare species; a thick infestation was, however, discovered on one occasion on the twigs of *Hura crepitans*;

*S. scutata* Newst., rare; a large colony was discovered in one instance on a cannon ball tree (*Couroupita guianensis*); the infestation covered the branches which bear fruit and flowers near the ground.

The following natural enemies have been observed in addition to those recorded in the last paper.

FUNGI. — *Cephalosporium lecanii* on *Coccus viridis*. When the weather is wet, *Pseudococcus sacchari* is subject to the attack of a green fungus which causes great mortality.

NEUROPTERA. — *Chrysopa claveri* Navas (fam. *Chrysopidae*) occasionally found attacking *Ps. sacchari*.

COLEOPTERA. — The *Coccinellidae* are among the most important enemies of scale-insects in the Colony. The following species have been observed and identified:

*Pentilia insidiosa* Muls., predaceous only on *Asterolecanium bambusae* Bdv.; it is a common species where this Coccid occurs;

*Hyperaspis festiva* Muls., commonly attacks *Ps. sacchari*;

*Hyp. orthopustulata* Muls., another common enemy of *Ps. sacchari*;

*Brachyacantha 10-punctata* Melsh., attacking a species of *Pseudococcus*; an uncommon species;

*Neda dilychnis* Muls., predaceous on *Aspidiotus destructor* Sign., an uncommon species, but found in this one instance occurring in large numbers on a heavily infested coconut palm.

HYMENOPTERA. — The following parasites have been bred from Coccidae at various times:

*Arrhenophagus chionaspidis* Auriv., obtained from *Hemichionaspis minor* Mark;

*Leptomastix dactylopii* Howard, from *Pseudococcus citri*, Risso;

*Lecaniobius cockerelli* Ashm., from *Saissetia nigra* Nietn.

The following species of ants have been observed to attend certain species of Coccidae:

*Daceton armigerum* Latr. found with *Ps. citri* on cacao pods;

*Cryptocerus atratus* L. with *Ps. citri*, *Coccus hesperidum* L., *Saissetia nigra*;

*Crypt. minutus* F. with *Pulvinaria pyriiformis* Ckll. and *Coccus hesperidum*;

*Ectatoma tuberculatum* Oliv. with *Saissetia nigra* on *Hibiscus esculentus*;

*Tetramorium guineense* F. with *Ps. sacchari* on sugar-cane; and with *Ps. citri* on cacao pods;

*Azteca schimperi* Em. with *Lecanium aequale* Newst. and *Ceroplastes avicenniae* on *Avicennia nitida*;

*Dolichoderus (Hypoclinea)* with *Ps. citri* on cacao pods;

*Solenopsis pylades* Forel with *Ps. sacchari* Newst.;

*Cremastogaster* sp. with *Pulvinaria flavicans* var. *formicicola*, *Coccus aequalis*, *Akermes quinquepori*, *Saissetia hurae*, *S. scutata*.



1101 — Observations on the Coccids, *Lecanium corni* and *Physokermes piceae*, in Wisconsin, United States. — FENTON, F. A., in *The Canadian Entomologist*, Vol. XLIX, No. 9, pp. 309-320, pl. XV-XVI. London 1917.

The investigations on the subject of *Lecanium corni* Bouché (European Fruit Lecanium) and *Physokermes piceae* Schr. (Spruce Scale) were made at Madison, in Wisconsin.

With regard to the first species, the writer not only touches upon its history, geographical distribution and economic importance, but also enumerates the very numerous host plants of the insect. He also gives the life-history and systematic description of this coccid, and then describes the experiments carried out for the purpose of determining whether *Lec. corni* can be transferred from one host plant to another. These experiments in a large number of cases gave negative results, but were not decisive.

Finally, the writer gives a list of the natural enemies (parasitic and predaceous insects, fungi) of this *Lecanium*.

The writer gives the history of *Phys. piceae*, speaks of its distribution in America (on *Picea* spp. and *Pinus Strobus*), describes its life-history, and concludes with a systematic description of this coccid and a list of its parasitic enemies.

1102 — Cotton Plants as Green Manure: a Method of Controlling the Mite *Eriophyes gossypii* and the Scale Insect *Saissetia nigra* in the Island of St. Kitts, Lesser Antilles. — SHEPHERD, F. R., in *The Agricultural Journal of India*, Vol. XII, Part. I, pp. 120-121. Calcutta, 1917.

MEANS  
OF PREVENTION  
AND CONTROL

On account of the numerous animal enemies attacking the cotton plant, such as the leaf-blister mite (*Eriophyes gossypii* Bks.) and the black scale (*Saissetia nigra* Niet.) it was formerly the custom, especially where successive cotton crops were grown, to burn the cotton plants, in order to exterminate the above mentioned parasites. The plants were generally pulled up and burnt about a month before the new crop was sown.

In the Island of St. Kitts, where cotton is only grown on the same field at intervals of about 2 or 3 years, the plant has always been used as a green manure instead of being burnt, for it was believed that the parasites could not remain alive so long.

In the experiment plots of La Guérite, the cotton plants were always pulled up and burnt until the last two years, when they were employed as a green manure. This practice was adopted after it was found that in a neighbouring field, where some old plants infested with *Er. gossypii* had been dug in before sowing the next crop, the new cotton plants were not especially attacked by this mite.

At La Guérite, for the last two years, cotton plants have been used as green manure about six weeks before the new sowings were made. It is necessary to pull up the cotton plants carefully, and not to cut them level with the soil, because in the latter case the old stock is apt to throw up shoots in which the mite still remains.

It is advisable, when possible, to dig in the cotton plants from at least 6 weeks to 2 months before resowing, in order to give the old plants time to decompose, and also for the purpose of decreasing the risk of harm to

the seed due to incomplete fermentation. Further, there is then less fear that the mite should be alive when the cotton crop is again sown.

1103 — **Animal Pests of wheat, in the Argentine.** — See No. 1016 of this *Review*.

1104 — ***Blitophaga opaca*, a Coleopteron Injurious to Barley, Beets and Potatoes in the Scandinavian Peninsula** (1) — KEMNER, N. A., in *Kungl. Landbruks-Akademiens Handlingar og Tidskrift*, Year 1917, No. 5, pp. 446-449, figs. 1-2. Stockholm, 1917.

*Blitophaga opaca* L. ("Gulhåriga Skinnarbaggen") hibernates under stones, among dry leaves and moss, and only emerges in late spring.

Copulation takes place in June. The eggs are laid in the soil and the larvae emerge towards the beginning of July (in Norbotten) Three weeks later, they pupate in the soil. The adult insect appears after 14 or 15 days.

The insect, both in the larval and adult stage, attacks the leaves of many cultivated plants.

It appeared in Sweden for the first time in 1889 in the Klövsjö barley fields (Jämtland district), and spread rapidly towards the north as far as Norbotten, as well as to the districts bordering on Norway and Finland.

Besides barley, *B. opaca* also attacks other crops, for example, potatoes (in Norway), sugar beets and mangolds (in Skåne, Östergötland, Öland, Halland).

Excluding the host-plant temporarily (for two or three years) from the field has no effect on the insect, because, owing to its capacity of adaptation, it immediately attacks other plants.

Possible methods of control are: 1) arsenical spraying of the larvae; 2) soil cultivation during the pupal stage.

In the same district, on the same plants, two other harmful coleoptera are found: — *Phosphuga atrata* L. ("Svarta Skinnerbaggen") and *Thanatophilus lapponicus* Herbst ("Lappska Skinnarbaggen").

1105 — ***Sitona lineata*, a Coleopteron Injurious to Leguminosae in Sweden** (2). — KEMNER N. A., in *Kungl. Landbruks-Akademiens Handlingar og Tidskrift*, Year 1917, No. 5, pp. 450-453, figs. 1-5. Stockholm, 1917.

The adults of *Sitona lineata* L. emerge in spring from their winter shelters and spread over leguminous plants (especially clover), attacking and destroying the young leaves and terminal buds. Copulation takes place early in summer, and the females lay their eggs on or near the surface of the soil. The larvae greedily attack the roots, especially the tubers and rootlets, sometimes leaving only the thin outer wall.

In Sweden this insect is common in districts where leguminous crops are grown and is found as far north as 61° in the Dalarna districts.

In spring, arsenical sprays might be used against the adult, but, in serious cases, the best method is not to grow leguminous plants for a certain number of years.

(1) See also R. May 1916, No. 568, and No. 1084 of this *Review* under the synonym of *Silpha opaca*. (Ed.)

(2) See also B. Nov., 1914, No. 1076 and R. July, 1916, No. 823. (Ed.)

1106 - *Meligethes aeneus*, a Coleopteron Injurious to Cruciferae in Sweden (1).

— KEMMER, N. A. in *Kungl. Landbruks-Akademiens Handlingar og Tidskrift*, Year 1917, No. 5, pp. 454-457, figs. 1-3. Stockholm, 1917.

The adults of *Meligethes aeneus* appear in small numbers in the spring in fields in flower and on fruit trees. Late in the season they attack turnips, cabbages and mustard in large numbers, damaging the tender parts of the plant, with a preference for the inflorescences, thus reducing the seed yield very considerably.

After copulation the eggs are laid in the buds and inflorescences, and the larvae complete the work of the adults by destroying the flowers and leaves.

The larval stage lasts two or three weeks. The pupae are found in the soil at a depth of about 10 cm., and the adults emerge after 12 to 14 days.

This insect is very common in Skåne as far as Norrland, and also in Götland, where, in 1892-1895, it almost completely destroyed the seed turnips.

Arsenical treatment is not to be recommended: 1) on account of the cost; 2) because, with arsenic salts, the pollen loses its germinating power; 3) because the insects, hidden among the leaves and flowers, easily escape the action of the poison.

## 1107 - Insects Injurious to the Cacao Plant in the Belgian Congo and Natal. — ARROW/

GILBERT, J., MARSHALL GUY, A. K., GAHAN, C. J. and DISTANT W. L., in *Bulletin of Entomological Research*, Vol. VIII, Part 1, pp. 111-118, fig. 1-3. London, 1917.

Amongst the material recently collected by Mr. RAYMOND MAYNE, Government Entomologist of the Belgian Congo, for making a special study of the insects living at the expense of the cacao plant in this region, there occur the following species which were observed in the district of Mayumbe. The writers give a systematic description of these parasites.

## A) COLEOPTERA:

a) fam. *Melolonthidae* (determinations made by G. J. ARROW):

1) *Aserica variegata* sp. nov., which destroys the young and tender leaves of the cacao plant; 2) *Pseudotrochilus concolor* Kolbe; 3) *Triodonta procera* Lansb.;

b) fam. *Curculionidae* (determinations made by G. A. K. MARSHALL):

1) *Systates ramosus*, sp. nov., which when adult attacks the foliage of fully developed plants; this species, however, is rare; 2) *S. Maynei* sp. nov., very abundant in the cacao plantations, where it is especially harmful to young plants in the nurseries. The injury is caused by the adult insect which eats large pieces of the margins of the leaves; 3) *Alcides theobromae* sp. nov., the larvae of this insect excavate longitudinal galleries in the small branches of the cacao plant; the leaves subsequently turn yellow, and the branches die; the individuals of *Alcides theobromae* are, so far, not numerous enough to constitute a serious danger to cacao-growing.



c) fam. *Lamiidae* (determinations made by C. J. Gahan): 1) *Tragocephala maynei*, sp. nov.; 2) *Exocentrus ortmansi*, sp. nov.

B) RHYNCOOTES:

fam. *Corcidae* (determination by W. L. DISTANT): *Pendulinus devastans* sp. nov.

Thanks to the last-mentioned writer, a description is added of another species, nearly related to the preceding one (*P. nigromarginatus*), which was found near Durban (Natal) and is probably also an insect injurious to crops.

1108 - **Mites Attacking Orchard and Field Crops in Utah, United States.** — DOANE, R. W., in *Science*, New Series, Vol. XLVI, No. 1182, p. 192. Lancaster, Pa., 1917.

During the summers of 1915 and 1916, certain mites were found to be particularly abundant and destructive to grain in Utah.

The most important of these was the common *Tetranychus bimaculatus* Harvey, which EWING believes to be the same as *T. telarius* Linn., which, as has already been pointed out, is an important pest on a surprisingly large number of crops. In 1916, it was so abundant in orchards that many cherry trees were completely defoliated before the end of August, and apricot, pear, plum and apple trees were only a little less seriously affected.

Raspberry and currant bushes suffered severely, some of them losing all their leaves.

Peas, beans, tomatoes and other kinds of kitchen-garden produce showed more or less injury in all stages of their development. In one field of sugar beets, the writer found many leaves drying and turning brown on account of the attacks of this mite.

The loss of the foliage of many ornamental plants, while not of so much economic importance, was very annoying.

Maize probably suffered more than any other field crop. In many fields practically every plant suffered the loss of some of its leaves, and in other places all the leaves turned brown and became thoroughly dry because of the presence of myriads of mites on their lower surfaces. The parts of the fields where the soil was lighter and drier usually suffered most, but no parts seemed to be immune from the attacks of this pest. The suckers and lower leaves were the first to be attacked and to show brown spots or streaks. When the trouble went no further it was of but little economic importance, but when the upper leaves were attacked and practically all destroyed, the plant withered and was not even good for fodder.

Many wheat fields also sustained considerable losses due to the attacks of the same mite. The wheat plants would be usually attacked a short time before the head burst from the sheath, and when the infestation was bad, the leaves would become dry and brown at the point of attack and the portion of the leaf beyond this would droop and dry out. Often all the leaves were affected in this way, and the heads, if they developed at all, were small and poorly filled.

Earlier in the season, while the wheat plants were much smaller, they were often attacked by two other species of mite. One of these is the well-

known clover mite, *Bryobia pratensis*, while the other, which is known as the jumping mite, was first named *Tetranychus longipes* by BANKS who now places it with two others in a new genus, *Tetranobia*.

In fields where *T. longipes* is abundant, the leaves turn distinctly grey, and many of them become so dry, that the growth of the plant is seriously affected.

Both *B. pratensis* and *Tetranobia longipes* were found destructively abundant not only on wheat, but on barley, oats, and many wild grasses.

1109 - **Two New Dipterous Cambium Miners.** — GREENE, C. T., in the *Journal of Agricultural Research*, Vol. X, No. 6, pp. 313-318, pl. 48. Washington, D. C., August 6, 1917.

This paper gives a systematic description of two new species of diptera, *Agromyza aceri* and *A. amelanchieris*, which mine in the cambium of living trees.

*Agromyza aceri* was found in the trunk and roots of red maple (*Acer rubrum*) at Falls Church, Virginia and at French Creek, West Virginia.

*A. amelanchieris* was found in the trunk and roots of the service berry, or shad-bush (*Amelanchier canadensis*) at French Creek. Nearly full-grown larvae were also collected at Smoky Mountain Crest, on the boundary line of Tennessee and North Carolina.

1974



INTERNATIONAL INSTITUTE OF AGRICULTURE  
BUREAU OF AGRICULTURAL INTELLIGENCE AND PLANT DISEASES

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The Bureau assumes no responsibility with regard to the opinions and the results of experiments outlined in the Bulletin

The Editor's notes are marked (Ed.).



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## ABSTRACTS

### AGRICULTURAL INTELLIGENCE

#### GENERAL INFORMATION.

1110 - Decree of the Minister for Agriculture Creating a Service of Agricultural Material in France. — *Journal Officiel de la République Française*, Year 49, No. 281, p. 8166. Paris, October 16, 1917.

LEGISLATIVE  
AND ADMINISTRATIVE  
MEASURES

Under date of October 15, 1917, the French Minister for Agriculture has published the following decree:

*Art. 1.* — A Service of agricultural material is instituted at the Ministry for Agriculture (Direction of Agriculture, Office for agricultural information).

*Art. 2.* — This Service has the function of providing material, particularly machinery, instruments and products required for agriculture.

It promotes the formation of industrial, commercial and agricultural groupings to facilitate production, exportation, distribution, sale and purchase and puts these associations into connection with manufacturers and industrial and commercial associations.

It provides for a just distribution of metals between makers and controls the prices, so as to avoid large increases.

*Art. 3.* — The head of the office for agricultural information, sent by the Minister of Agriculture as delegate to the Commission for metals and war manufactures, directs the Service for agricultural materials. He signs the correspondence of the Service and gives endorsements and permits. The questions prepared by the Service, which should be approved by the Minister, are signed by him and presented to the Director of Agriculture.

*Art. 4.* — The Director of Agriculture is responsible for carrying out this decree.

1111 - Laws and Orders concerning the Production, Preservation and Sale of Milk and Cream, in the United States. — See No. 1228 of this Review.

1112 - **Agricultural Development in South Africa.** — In *The Board of Trade Journal*, Vol. XLVIII, No. 1086, pp. 627-630. London, September 20, 1917.

In his Report for 1916 the General Manager of Railways and Harbours in South Africa states that the past year was notable for the extensive development of agricultural and other industries in South Africa.

**AGRICULTURE.** — Experiments in the cultivation of *sugar beet* are being conducted in the Oudtshoorn district, and a movement is on foot to increase the area of its cultivation and to ascertain by trial whether the beets will thrive in the fertile localities of the Karroo. The yield of sugar from beets is stated to have been satisfactory.

During 1916 important developments took place in the *frozen meat industry*. Cold storage and chilling facilities are being increased at Pretoria, Bloemfontein, Maritzburg, and Durban, and the Railways and Harbours Administration is co-operating in arrangements for an export trade. Municipalities are extending and improving their abattoir facilities.

There have been marked developments in the *creamery* and *dairy* business; twelve creameries and fourteen cheese factories have been established in the Union since the outbreak of the war.

One result of the difficulty in obtaining space for exports of *fresh fruit* has been the production of larger quantities of *dried fruit*. Large tinning, drying and jam factories have been established. About 20 000 tons of jam, of which 4 000 tons were exported, were made at Paarl and Wellington during the year.

The 1916 *tobacco* crop in the Rustenburg district was large and of better quality than that of the previous year. An effort is being made to develop an export trade from this district, and farmers propose to cultivate the plant on a more extensive scale.

**FORESTRY.** — The shortage of tonnage and the difficulty of procuring supplies of imported timber have led to a noticeable development in the local *timber industry*. Since the war commenced, South African timbers have replaced imported wood formerly used for many purposes in the mines, and are also being extensively used for wagon building, furniture, box making, floor boards, and other building purposes.

*Boxwood* is now being exported in considerable quantities, and but for the shortage of tonnage this trade would have greatly developed.

Two *match factories* are using local woods exclusively for their products. *Fruit boxes*, which were formerly imported in large quantities, are now being manufactured in South Africa.

The *wattle bark industry* has made rapid progress in recent years, and, as a result of the war, an allied industry, namely, the preparation of wattle extract, has been established. Factories for the preparation of the extract have been erected at Maritzburg and Merebank in Natal. Altogether about 500 tons of extract were exported during 1916.

In addition to exports of bark to the United Kingdom, India, Australia and the United States, where the demand for wattle bark is increasing, a new market has been opened up in Russia and Japan, 7286 tons of bark having been exported to the former country in 1916, and 690 tons to the

latter. In order to economise ships' space, an experiment has been made with pressing and baling the bark, and the result was satisfactory.

The *manufacture of tannin* in South Africa has aided the work of the numerous large *tanneries* in the Transvaal, Natal and Cape Province, which are showing signs of progressive development. Three boot factories in the vicinity of Cape Town and boot and shoe factories at Great Brak and Port Elizabeth are working on an extended scale. In a large tannery and boot factory established at Pretoria since the war all the material used for tanning hides are of local manufacture. A tannery has also been established at Zandfontein.

**FERTILISERS.** — *Sheep-dip* and *nitrate of soda* for fertilising purposes — both new industries in South Africa — are being despatched in considerable quantities from works at Firgrove.

Large works for the manufacture of ammonia have been erected near Vryheid, the principal product at present being *sulphate of ammonia*.

Quite substantial industries for the supply of *fertilisers* have been started at various centres.

1113 — **Studies of Food Utilisation: the Utilisation of Carbohydrate on Relatively High and Relatively Low Cereal Diets.** — ZENTMIRE, ZELMA and FOWLER, CHESTER C., in the *Journal of Biological Chemistry*, Vol. XXXII, No. 1, pp. 77-85, bibliography of 25 publications. Baltimore, October 1917.

This study was carried out at the Laboratory of Physiological Chemistry of the Iowa State College, in order to ascertain how much, if any, difference occurs in the utilisation by the organism of cereal protein and cereal carbohydrate when ingested in varying amounts in the form of thoroughly cooked "cream of wheat". The article analysed gives the results relating to the carbohydrates.

The experiment lasted 3 weeks, divided as follows: 5 days of lower cereal diet; 5 days of higher cereal diet; 2 days each of nitrogen-free lower, and higher starch diets; preliminary and intermediate periods of 2 days each in which a simple mixed diet was ingested. To the cream of wheat and the starch pudding were added only small quantities of milk, sugar and butter.

The cereal and starch were boiled a few minutes on the stove, then placed in a large fireless cooker overnight.

In all cases the lower diet was equal to half the higher diet.

The results obtained led to the following conclusions:

1) The utilization of total carbohydrates of a diet consisting largely of cereal is above 99 per cent.

2) The carbohydrate is as completely utilised with one quantity as another of cereal in the diet, even when the cereal is taken in larger amounts than are found in the average dietary.

3) Monotony and unpalatability of diet have little or no effect upon the ultimate utilisation.



## CROPS AND CULTIVATION.

SOIL PHYSICS,  
CHEMISTRY  
AND  
MICROBIOLOGY.

1114 — **Relation of the Water-Retaining Capacity of a Soil to Its Hygroscopic Coefficient.** — ALWAY, F. J. (Chief of Division of Soils), and MC DOLE, G. R. (Assistant in Soils, Agricultural Experiment Station, University of Minnesota), in the *Journal of Agricultural Research*, Vol. IX, No. 2, pp. 27-71, fig. 4, bibliography of 25 publications. Washington, 1917.

In recent years, the importance of the water contained in the deeper portions of the subsoil — that below the depth penetrated by the roots of crop plants — has been a much discussed question regarding which opinion is much divided. The present differences in view, according to the writers, appear to be due to the failure (in laboratory experiments and field studies) to take into consideration some physical constant that is directly related to the lower limit of available moisture (which practically coincides with the hygroscopic coefficient) and the maximum water-retaining capacity of the soil.

After reviewing previous work on this subject, the writers describe experiments carried out with uniform columns of soil of known hygroscopic coefficient and moisture equivalent (1) and known maximum water capacity and nitrogen content, for the purpose of ascertaining the movement of water in the soil under different conditions. The 13 soils (soils and subsoils) used, ranged in texture from a coarse sand to a silt loam with hygroscopic coefficients of 0.6 and 13.3 respectively.

Five of the loams placed in capillary connection with the natural subsoil mass and allowed to stand protected from surface evaporation for some months, lost water until the amount retained bore a close relation to the hygroscopic coefficient, being from 2.1 to 3.1 times this value, according to the particular soil. When, however, a layer of coarse sand or gravel separated the column of loam from the subsoil, the downward movement of the water in the soil above this layer was much delayed. Where the column consisted of successive 2-inch layers of loam differing widely in texture, the order of their arrangement exerted no influence upon their final water content.

Soil columns 30 to 36 inches long, while protected from all loss of moisture at the sides and bottom, were freely exposed to evaporation at the surface for periods varying from 3 weeks to 6 months. The moisture content, originally uniform and lying between 2.0 and 3.0 times the hygroscopic coefficient, fell until it reached, at depths below the first foot, an almost constant minimum with the ratio 1.9 to 2.2.

Employing 2-foot columns of 12 different loams, each with an initial moisture content approximately equal to its hygroscopic coefficient, enough water was added to raise the average moisture content of the column to 1.5 times the hygroscopic coefficient. After the cylinders had stood 3 or 4

(1) The moisture equivalent represents the capacity of capillary water. For this term, as well as the preceding and following terms, see B. 1912, No. 903. (Ed.)

months fully protected from evaporation, the distribution of moisture with regard to the surface to which it had been applied was found to be the same in both experiments. The maximum final ratio of  $\frac{\text{moisture equivalent}}{\text{hygroscopic coefficient}}$  was found 3 inches from the surface of application with values ranging from 1.7 to 2.4. This ratio, however, is not the same for all the soils that have the same hygroscopic coefficient. The water-retaining capacity of loams, as determined by laboratory experiments, was found to bear a somewhat closer relation to the moisture equivalent than to the hygroscopic coefficient.

Coarse sands exhibited a behaviour very different from that of the loams, for 3 months after 1 inch of water had been applied to the surface, the ratio of  $\frac{\text{moisture equivalent}}{\text{hygroscopic coefficient}}$  was as high as 6.0 or 7.0 at 6 inches from the surface, while in the second foot it was only 1.0. These results were confirmed by field studies. Fine sands occupy an intermediate position between the loams and the coarse sands.

Field studies also show that when loams, after rains sufficiently heavy to moisten them thoroughly, are protected from loss by evaporation and transpiration they lose water by downward movement until the ratio of  $\frac{\text{moisture equivalent}}{\text{hygroscopic coefficient}}$  lies between 1.8 and about 2.5, and accordingly on the uplands of dry-land regions, this is the ratio to be expected in the deeper sub-soil — the portion below the range of plant roots.

A comparatively abrupt transition from the moistened soil to the thoroughly exhausted underlying layers, with ratios of 2: 2.5 and 1.0: 1.1 respectively, is found even several months after liberal rains have fallen.

It is clear that the moisture of the deeper sub-soil will be able to move upward only so slowly and through such a short distance in a single season, that it will be at most of no practical benefit to annual crops, and the only way to make use of this moisture is to follow such crops at intervals by deep-rooting perennials.

Further experiments, however, of a long-time character are necessary to decide definitely whether the deep sub-soil may not in a decade or so contribute sufficient moisture to the subsoil within the reach of such perennials, 20 to 30 ft., to make such a contribution of some practical importance for such crops.

**1115 — On the Supposed Relative Unilateral Impoverishment of the Soil in Nitrogen, Phosphoric Acid and Potassium by Various Crops; Action of the Root System of the Plants.** — МОДЕСТОВЪ А. (MODESTOV, A.), in *Земледельческая Газета* (*Agricultural Gazette*), No. 8 (176), pp. 174-176. Petrograd, February 25, 1917.

It is generally admitted that various crops impoverish the soil in nitrogen, phosphoric acid and potassium in various proportions. This has led to distinctions being made in this respect between different groups of plants; for example, cereals are considered particularly exacting in nitrogen and phosphoric acid, whereas tubers demand much potassium, etc. These considerations are included in the principles of crop rotation.

The author acknowledges that the various cultivated plants extract



fertilising elements from the soil in different proportions, but, on the basis of calculations concerning the average yields of the various crops (wheat, oats, beet, potato, buckwheat, clover, etc.), he concludes that the *total* quantities of nitrogen and phosphoric acid extracted from the soil by these plants are *almost equal*, so that it is not possible to admit a relative unilateral impoverishment in these two elements by the different crops. On the other hand, there are differences in the total quantities of *potassium* extracted by the crops.

These conclusions, based on elementary calculations, clash with the present theory of crop-rotation.

How then is it possible to explain the fact that, with crop rotation, a given plant, wheat for example, gives higher yields than with continuous cropping? Thus, in the experimental fields at Poltawa (Russia), wheat following after wheat yielded 8  $\frac{1}{4}$  cwt. per acre, whereas, following on plants which extract the same quantity of nitrogen and phosphoric acid, it yielded from 9  $\frac{1}{2}$  to 11 cwt. of grain per acre. The potassium has not been taken into consideration, because wheat requires but little, and it was precisely after crops demanding much potassium (beets, potatoes, buckwheat, etc.) that it gave the highest yields. In this case it is impossible to talk of a *minimum* of potassium resulting from a relative unilateral impoverishment. It is clear that here the rotation of the crops has no importance.

If indeed this increased yield of wheat does not depend on rotation (in the sense either of a relative unilateral impoverishment or enrichment), what is the probable cause of the decreased yields given by continuous cropping of the same plant and the increased yields obtained by rotation? The author believes it may be accounted for by the following causes:

1) *Total quantity of moisture extracted from the soil by various crops.* It must be noted that root crops, which extract 1.6 times more moisture from the soil than wheat, cannot, in this respect, have any beneficial influence on the following wheat crop, rather they will have deprived it of water in advance.

2) *Physical condition of the soil.* This is more favourable to nitrification and the accumulation of moisture in the case of hoed crops than in that of wheat. It is to the better physical condition in which hoed plants leave the soil that their beneficial influence on the following crops must be attributed rather than to the different requirements of the crops in fertilising elements.

3) *Differences in the root system of the plants cultivated.* If, for example, beets and oats are compared from this point of view, there is reason to believe that the point of contact of the roots with the soil particles differs in the two plants. On the other hand, the principal parts of the roots of oats and beets develop in different layers of the soil. The author believes this difference in the position of the root system of the plants grown is the real cause of the favourable action of crop rotation.

Attention is also drawn to the different dissolving capacity of roots of various plants and to DE CANDOLLE'S theory of poisoning of the soil.



Finally the author points out the necessity of examining the prevailing theory of soil "fatigue", which attributes this fatigue to a relative unilateral impoverishment of the soil in nitrogen, phosphoric acid and potassium in plants which are cropped continuously, for, as has been seen, this impoverishment cannot be sufficiently great to be of practical importance.

**III 6 - The Effect of Soil Reaction on the Availability of Ammonium Sulphate. —**

COOK, R. C. and ALLISON, F. E. (Rutgers College), in *Soil Science*, Vol. III, No. 5, pp. 487-498, fig. 2. New Brunswick, N. Y., 1917.

Experimental researches on the effects of applying increasing amounts of lime to 3 types of soil: sand, sandy loam and silt loam. These soils had respectively a calcium oxide (CaO) requirement of 3000 lbs., 3000 lbs. and 4000 lbs. per acre. These effects were studied in connection with the application of varied amounts of ammonium sulphate to pot cultures of buckwheat. All the pots received an excess of potassium and phosphorus, and the soil was made up to optimum moisture content.

With small applications of calcium oxide, practically as large yields of buckwheat were obtained as where enough lime was added to neutralise all the acidity, or make the soil distinctly alkaline. The beneficial effects of calcium oxide on acid soils were much more noticeable on the sandy soils than on the silt loam. Buckwheat grown on the more acid soils usually showed a higher nitrogen content, but the total yield of the crop was smaller. For this reason, the recovery of the nitrogen from the more acid soils in many cases was as great as, or even greater, than from the alkaline soils. Further, the addition of calcium oxide to acid soils allows the soil nitrogen to be made available to such an extent as to supply the needs of the crop. Hence the use of ammonium sulphate on alkaline soils may produce a smaller increase in yield than where the same amount is added to an acid soil. Buckwheat is able to use the nitrogen from ammonium sulphate at an acidity of 3000 lbs., or 4000 lbs. of calcium oxide per acre. This nitrogen is either taken up as ammonia, or else nitrification proceeds to a considerable extent in the presence of the acid. The yield of dry matter on the acid soils is low, not because of lack of available nitrogen, phosphorus, or potassium, but probably on account of the unfavourable medium in which the plants must grow.

**III 7 - Livestock and the Maintenance of Organic Matter in the Soil. —** FIPPIN, E. O.

in the *Journal of the American Society of Agronomy*, Vol. 9, No. 3, pp. 97-105, fig. 1 Lancaster, Pa., 1917.

Since organic matter in the soil is universally recognised as necessary to its maximum productiveness and the maintenance of organic matter constitutes one of the most difficult problems of practical farming, the writer has desired in his paper: 1) to lay more stress upon the importance of the organic constituents than is generally done: 2) to direct attention to the fact that the effect of animals upon their feed has not been emphasised in the ordinary discussion of soil maintenance and animal husbandry.

The most important conclusion drawn by the writer is, that the higher plants are able to use organised carbonaceous foods, both nitrogenous and non-nitrogenous; these foods conserve energy in the process of growth of the

crop and make possible a larger total growth in a given time. The organic matter in the soil is the direct source of the carbonaceous material used by the plant; therefore any process that permits the destruction of organic matter that might find its way into soil is likely to be poor economy. Animals destroy from 50 to 90 per cent. of the organic matter in the feed consumed. It is burnt up in the body processes and expended as energy: a further large loss occurs in the handling of the manure. It is impossible to maintain the organic matter in the soil without animal husbandry. On very poor soils, stock-keeping may be bad practice, but it may be justified by large profits from the animal products by means of which the loss of organic matter can be made up from other sources.

**1118 — Soil Constituents Which Inhibit the Action of Plant Toxins.**—TRUOG, E. (Soil Chemist) and SYKORA J. (Department of Soils, College of Agriculture, University of Wisconsin), in *Soil Science*, Vol. III, No. 4, pp. 333-352, bibliography of 48 publications, V plates. New Brunswick, N. Y., April, 1917.

The writers apply the term plant toxins to those substances which, at concentrations considerably below the osmotic equivalent of the cell sap, are injurious to living plant protoplasm. This definition includes both inorganic and organic compounds, which may be acidic, basic or neutral in character.

It seems that there are certain soil constituents which inhibit the action of plant toxins. In order to ascertain whether this inhibitory action was mainly due to physical factors (adsorption) or chemical factors or both, the writer first carried out a series of pot cultures of wheat where the *physical* conditions depended upon the materials used in the preparation of the artificial soil: 1) pure quartz sand; 2) quartz sand + quartz flour; 3) quartz sand + kaolin; 4) quartz sand + superior red clay. The *chemical* conditions, however, depended on the presence, or absence, of calcium carbonate. The cultures were grown in the necessary nutrient solutions, to which were added the toxic substances experimented with. The following facts were recorded by the writer:

*Copper Sulphate and Copper Nitrate.* — The toxic action of copper sulphate was slightly decreased when the surface of the artificial soil particles was increased by the addition of quartz flour or kaolin, but this beneficial effect was very small as compared with that exercised by calcium carbonate, which completely destroyed the toxic action both of copper sulphate and copper nitrate.

*Sodium Arsenite.* — The toxic action of sodium arsenite was reduced by the addition of quartz flour to the sand in the pots; on the other hand, the addition of kaolin did not give this good result. It therefore seems probable that, in the first case, the beneficial effect was not due to the physical condition of the quartz flour, but to certain impurities known to be present in quartz flour, and which acted as catalytic agents in the oxidation of sodium arsenite. Calcium carbonate had practically no effect in reducing the toxic action of sodium arsenite.

*Guanidine Carbonate.* — In this case, on the contrary, the presence of kaolin in the soil of the pots had a beneficial effect, inhibiting the toxic



action of the guanidine carbonate and thus promoting the development of the wheat, while quartz sand had no effect, and calcium carbonate was actually injurious. The beneficial effect of kaolin may be attributed to its acid nature, which allows of its combining with guanidine in such a manner as to render the latter inactive. This would explain the behaviour of the calcium carbonate (not acid) and would be confirmed by another experiment in which the kaolin was replaced by distinctly acid red clay.

The writers afterwards made a series of pot experiments with 2 natural soils, both acid: 1) infertile acid sand; 2) fertile silt loam. This time they used vanillin as the toxic agent. Vanillin proved distinctly toxic on the poor, sandy soil where neither nutrients nor limestone were added, whereas it had no toxic effect on plants grown in the fertile silt loam.

From all the results obtained, the writers conclude that, in the amelioration of toxicity in soils, chemical reactions play as important a part as physical phenomena (such as adsorption), and possibly the former have the greater effect.

1119 - **The Soils of Hawaii.** — BURGESS, P. S., in *Report of Work of the Experiment Station of the Hawaiian Sugar Planters' Association*, Bulletin No. 45 (Agricultural and Chemical Series), p. 100. Honolulu, Hawaii, 1917.

This Bulletin opens with a general account of the formation, physical, chemical and biological properties of the soil, after which the soils of the Sandwich Islands, and those of Hawaii in particular, are discussed. The Hawaiian soils are of particular interest, being of volcanic origin and situated under very varying climatic conditions. They are chiefly laterites, with a very high content of iron, aluminium and the alkaline earths, but with a low silica content. Due to pre-existing tropical verdure, most of the soils contain large amounts of humus and nitrogen. The total phosphoric acid and soluble silica are also usually high. The following table gives the results of a number of analyses (by the strong acid digestion method) of Hawaiian soils, a number of analyses of American soils being included for comparison.

*Comparative Percentage Composition of American and Hawaiian Soils.*

	Total SiO <sub>2</sub>	Solu- ble SiO <sub>2</sub>	K <sub>2</sub> O	Na <sub>2</sub> O	CaO	MgO	Mn <sub>2</sub> O <sub>4</sub>	FeO + Fe <sub>2</sub> O <sub>3</sub>	Al <sub>2</sub> O <sub>3</sub>	P <sub>2</sub> O <sub>5</sub>	SO <sub>3</sub>	N
American Soils . .	85.52	6.40	0.40	0.27	0.75	0.68	0.12	3.81	5.15	0.16	0.04	0.18
Hawaiian Soils . .	32.63	17.59	0.34	0.35	1.30	1.18	0.50	28.02	20.72	0.35	0.32	0.33

The rainfall varies considerably, arid conditions prevailing in certain areas, while over a large part of the uplands and on the windward side the rainfall is excessive (200 to 300 inches per annum in certain districts).

Physically the soils of Hawaii are unique. They can mostly be classed as high humus clay and silty clay loams, although the amounts of



true clay (hydrated aluminium silicates) in all cases are very low or nil. Colloidal aluminium and iron hydrated oxides give to the soils their apparent clayey characteristics. The soil moisture conditions are discussed fully, the moisture coefficients being shown to be abnormally high. The hygroscopic coefficients vary from 9 to over 26 per cent. (determined by HILGARD'S standard method), while the optimum moisture capacity averages about 45 per cent. of the dry weight of the soils. The "free water" varies from 15 to 38 per cent. while the maximum water holding capacity is well above the average of ordinary soils. The soils do not usually cake badly unless very puddled, and under good conditions give a good tilth.

The writer then gives an account of his physical, chemical and bacteriological studies of the soil, together with such practical interpretations as may be useful to the agriculturists of Hawaii. As regards the bacteriological work, soil nitrification was thoroughly studied. Forms of the nitrogen-fixing *Azotobacter* were found to be well distributed.

The bulletin closes with a discussion of the analytical and other methods employed in the course of the work.

**1120 - Variations in the Chemical Composition of Soils in the United States. —**

RO INSON, W. O., STEINKOENIG, L. A. and TRY, W. H. (Scientists in Chemical Investigations), in *United States Department of Agriculture, Bulletin No. 515, Contribution from the Bureau of Soils. Washington, 1917.*

Determinations of the chief constituents in 45 samples of 18 typical soils of the United States ranging from sands to clays.

The writer confirms the previous observations according to which a distinct difference in texture and colour between soil and sub-soil is generally accompanied by a no less well-defined difference in the chemical composition, especially as regards the amount of silica, iron and alumina present. Thus, samples of soil and subsoil taken from 35 localities show that these substances are more plentiful in the subsoil than the soil :

for silica	in all cases investigated, except 2
for iron	»    »    »    »    5
for alumina	»    »    »    »    1

The soils analysed were so different as regards : nature of original materials ; mode of formation ; topographical conditions ; climatic conditions ; that probably they give for some constituents almost the extremes of the composition of the soils of the United States. These extremes would be :

Silica . . . . .	44.15	—	97.01 %
Iron . . . . .	0.33	—	16.23
Alumina . . . . .	1.19	—	27.58
Potassium . . . . .	0.02	—	4.07
Sodium . . . . .	0.01	—	2.06
Calcium . . . . .	0.01	—	1.73
Magnesium . . . . .	0.01	—	1.93
Phosphoric acid . . . . .	0.03	—	0.22
Sulphurous acid . . . . .	0.02	—	0.34

Some soils of the same type may differ considerably as to their chemical composition. On the other hand, certain soils belonging to different types can have as similar a chemical composition as the various samples of the same type. As regards the limits of analytic error (0.10 per cent. for calcium — 0.05 per cent. for potassium — 0.05 per cent. for phosphoric acid), it must be remarked that differences of hundreds of pounds due to this source are not of great practical importance in giving the constituents of a soil in lbs. per acre for a layer 6 in. in depth.

**1121 — Studies on Soil Colloids in the United States.** — I. WOLKOFF, M. I. (Michigan Agricultural College), Flocculation of Soil Colloidal Solutions, in *Soil Science*, Vol. I, No. 6, pp. 585-601, fig. 3, bibliography of 43 publications. New Brunswick, N. J., 1916. II. IDEM, Influence of Colloids on Electrical Conductivity of Salts, Vol. III, No. 5, pp. 423-430, fig. 2, tables III, bibliography of 9 publications. New Brunswick, 1917.

I. — The present state of our knowledge of flocculation of soil particles is based largely upon 3 sources of information, namely: 1) deductions from general colloidal chemistry, 2) studies with kaolin, and 3) studies with different clays.

The writer is of opinion that the study of the colloidal solutions of different soils is the best method of understanding the phenomenon of flocculation in soil. He investigated 7 types of soil, including kaolin, and 67 electrolytes. The chief results of his researches were as follows:

1) The flocculating power of different electrolytes varies for the same colloidal solution.

2) The flocculating efficiency of the same electrolyte varies considerably according to the colloidal solutions from different soils, for it largely depends upon their chemical composition.

3) SCHULZE'S valency law does not hold true with the soil colloidal solutions studied, since the humic substances present hinder the coagulating power of the electrolytes.

4) It takes a greater amount of electrolyte for flocculation of a more concentrated soil colloidal solution than that for a less concentrated one. Thus in the flocculation of the soil colloidal solutions by the electrolyte, the action obeys, within the experimental error, the law of mass action.

II. — In the second series of experiments, the writer used colloidal solutions obtained from a clay nearly devoid of organic matter; thus the colloidal solutions were *mineral* solutions. He was able to make the following observations:

1) The inorganic colloidal particles, as found in clay, especially the colloidal gels, hinder the electric conductivity of salt solutions, especially at the moment of complete coagulation.

2) The causes for such an interference lie possibly in a) the fact that colloidal particles moving comparatively slowly are in the pathway of the free ions, and b) that the change of the structure of the gel at the point of coagulation results in an increase in the adsorptive capacity of colloids.

3) The adsorption of electrolytes by the gel increases with the increase of the electrolyte present for coagulation.

4) The coagulation of the colloid solutions by means of certain elec-



trolytes can be employed for separation of colloids from crystalloids, provided that only a minimum amount of electrolyte be used for a complete coagulation in order to reduce to the minimum the error due to adsorption.

**1122 - On the Physiology and Biology of Nitrogen-Fixing Bacteria.** — OMELIANSKY, V. I., in the *Archives des sciences biologiques de Pétrograd*, Vol. XIX, No. 3, pp. 209-227, 1916; summary by SAZERAC, R., in the *Bulletin de l'Institut Pasteur*, Vol. XV, No. 5, pp. 133-134. Paris, 1917 (1).

The writer is contrary to the general opinion, according to which *Clostridium pasteurianum* is considered of less practical importance than *Azotobacter* as regards nitrogen-fixation. The above paper contains a critical discussion of the most important and recent work on *Clostridium*, certain new experiments being added to complete the knowledge of certain interesting facts relating to the biology and physiology of that organism.

In relation to the *optimum* temperature the writer notes that growth is more abundant and the fermentation of sugar more energetic at about 30° C, but nitrogen-fixation is less than at the ordinary temperature. *Clostridium* may be heated to 75° C without destruction; other non-sporing species can, therefore, be eliminated by prolonged pasteurisation at that temperature. Spores of *Clostridium*, preserved in the dry state in air for 20 years, gave vigorous cultures that had not lost their power of nitrogen-fixation.

With cultures in the presence of carbohydrates, the fermentation of 10 carbohydrates (dextrose, laevulose, saccharose, galactose, maltose, raffinose, dextrin, inulin, glycerin, mannite) was observed, while WINOGRADSKY had only observed the fermentation of 3. The most vigorous growth took place in media containing dextrose, raffinose, inulin and mannite. The concentration of the sugar has a great influence on the nitrogen-fixation by *Clostridium*, as is the case with *Azotobacter*; the greater the concentration the less the nitrogen fixation per gram of sugar.

The manner in which the nitrogenous food is supplied has effect on nitrogen-fixation. Too large an increase in nitrogen-content of the medium decreases fixation, finally stopping it. Nevertheless, with a *Clostridium* from Volhynie, isolated by the writer, nitrogen-fixation still took place when the nitrogen and sugar of the medium were in the ratio as 16 : 1000, whereas fixation was stopped when the ratio was as 6 : 1000, according to WINOGRADSKY.

The Author strongly upholds WINOGRADSKY'S opinion, that considers *Clostridium* as a typical butyric ferment, and he has found that the power of fixing nitrogen is very general in the group of butyric bacteria.

**1123 - New Method for the Estimation of "Zeolitic" Silicic Acids in Soils.** — ГЕДРОЙЦ Г. (GUEДРОИЦ, G.), in *Журналъ Опытной Агрономіи имени П. С. Коссовича* (*Review of Experimental Agronomy dedicated to the memory of P. S. KOSSOVITCH*), Vol. XVII, No. 5, pp. 400-407 (with summary in French). Petrograd, 1916.

The estimation of the "zeolitic" silicic acid which is liberated during the treatment of soils with concentrated, hot hydrochloric acid, is of great



importance in certain deductions concerning the course of the transformation of soils and their formation. The method generally used in Russian laboratories for the estimation of "zeolitic" silicic acid gives thoroughly good results, but it is fairly long, and requires the use of large platinum dishes. By VAN BEMMELEN'S method the silicic acid is not completely liberated, and there are also certain technical difficulties. The author has devised a new method which is more rapid, does not require the use of large platinum dishes and gives equally satisfactory results.

Five grammes of soil are heated after having been treated with 10 % hydrochloric acid. For this purpose small platinum dishes are used and a gas burner with a movable top bored with holes. The temperature must not exceed 62.5° C. After complete destruction of the organic matter and cooling, the burnt soil is put into a beaker, to which is added water and 100 cc. of 5 % caustic potash solution. The liquid is stirred, heated over the water-bath for 1½ hour, and then filtered; as the first part of the liquid is always rather thick, it is re-filtered. The contents of the funnel are washed 10 times with a dilute solution of caustic potash (1 %). The filtered liquid, acidified with hydrochloric acid, is evaporated and dried for 1 to 1½ hours over a sand-bath at 125 to 150° C. The silicic acid, now completely insoluble, may be isolated by filtering, after being washed very thoroughly, so as to leave no trace of chlorine.

1124 — Irrigation Technique for Sugar-Beets, in Utah, U. S. A. — See No. 1157 of this Review.

1125 — Irrigation and Manuring Studies; The Effect of Varying Quantities of Irrigation Water and Manure on the Growth and Yield of Corn. — HARRIES F. S. and PITTMAN, D. W., in *Utah Agricultural College Experiment Station, Bulletin* No. 154, pp. 29, figs. 14. Logan, Utah, April, 1917.

PERMANENT  
IMPROVEMENT  
IRRIGATION

This bulletin reports the results of an experiment on the irrigation and manuring of corn for the six years from 1911 to 1916 inclusive (1).

The highest yield of grain was obtained with 20 inches of water and the highest yield of stover with 30 inches. Where as much as 40 inches of water was applied, the yield of crop was decidedly decreased; the extra water was not only wasted but the time used in applying it was lost and the fertility of the land injured. The value of an acre-inch of water was found to be about as follows when different quantities were applied: For 5 inches, \$1.90; for 10 inches, 87 cents; for 20 inches, 69 cents; for 30 inches, 42 cents; and for 40 inches, 24 cents for each acre-inch. Mixed horse and cow manure, when applied at the rate of 5 tons per acre, increased the value of the crop by \$3.57 for each ton of manure; and when applied at the rate of 15 tons per acre, it increased the crop by \$1.56 for each ton.

The nitrogen content of the grain was reduced by those irrigation treatments that increased the yield of the crop; manure increased the percentage nitrogen in the grain. The phosphorus content of the grain was

(1) The first three years' results, here reported, have been published in *Utah Agricultural College Experiment Station, Bulletin*, No. 133. (Ed.)

affected irregularly by irrigation, but it was increased by manure. The calcium and magnesium content of the grain was not regularly influenced by the treatments.

It seems that under the conditions of the experiment, 20 acre-inches is the best amount of water to use on corn. The application of as much as 5 tons of manure per acre to corn each year was profitable on a clay loam soil as experimented.

Details are given regarding the effect of irrigation and manure on the relative quantity and size of the various plant parts: yield of ear corn, shelled corn and cobs; weight of grain per bushel and of 1000 kernels; number of ears and stalks per plot (7 × 24 feet); number of leaves per stalk; yield of stalks, leaves and husks; length of ears and leaves; width of leaves; number of branches per tassel; nitrogen and phosphoric acid in kernels.

II26 — **Comparative Value of Legumes as Green Manure.** — JOHNSON, MAXWELL O., THOMPSON, ALICE, R. and SAHR, C. A., in *Hawaii Agricultural Experiment Station, Honolulu, Press Bulletin* No. 52, 14 pp. 6 fig. Honolulu, February 24, 1917.

In experiments conducted by the Chemical Department of the above-mentioned Station, 32 varieties of legumes were grown on 2 soils of different type: 1) dark brown Honolulu clay: 2) an acid red clay from the Kuna district of the Island of Oahu. Three crops were grown of each of the varieties of legumes, using 4 pots for each trial of each variety. At matu-

TABLE I. — *Approximate Content of Legume Varieties*  
(calculated on the basis of a ton of fresh cut stems and leaves).

Variety	Nitrogen in total plant	Nitrogen in stems and leaves	Nitrogen in roots
	lbs.	lbs.	lbs.
Sunn hemp ( <i>Crotalaria juncea</i> ) . . . . .	20.2	16.0	4.2
Indigo plant ( <i>Indigofera Anil</i> ) . . . . .	28.4	20.4	8.0
Rattlepod ( <i>Crotalaria Saltiana</i> ) . . . . .	23.5	15.3	8.2
» ( <i>C. incana</i> ) . . . . .	18.9	15.9	3.0
Oregon Vetch ( <i>Vicia americana</i> ) . . . . .	20.0	12.3	7.7
Jack bean ( <i>Canavalia ensiformis</i> ) . . . . .	16.3	15.0	1.3
Velvet bean ( <i>Stizolobium Deeringianum</i> ) . . . . .	14.0	11.7	2.3
Otootan Soybean ( <i>Soja otootan</i> ) . . . . .	20.0	15.7	4.3
Partridge pea ( <i>Cassia Chamaecrista</i> ) . . . . .	23.7	19.6	4.1
Cowpea ( <i>Vigna Catjang</i> ) . . . . .	12.1	10.6	1.5
Hairy Vetch ( <i>Vicia villosa</i> ) . . . . .	13.3	9.4	3.9
Florida beggar weed ( <i>Desmodium tortuosum</i> ) . . . . .	19.0	15.6	3.4
Barclay soy bean ( <i>Soja max</i> ) . . . . .	21.2	15.6	5.6
Spanish clover ( <i>Desmodium uncinatum</i> ) . . . . .	19.8	12.8	7.0
<i>Sesbania aegyptiaca</i> . . . . .	11.4	7.1	4.3
German lupin ( <i>Lupinus luteus</i> ) . . . . .	8.7	7.1	1.6
<i>Phaseolus semierectus</i> . . . . .	17.3	13.6	3.7
Mung bean ( <i>Phaseolus Mungo</i> ) . . . . .	15.5	13.8	1.7
Kulthi ( <i>Dolichos biflorus</i> ) . . . . .	12.5	11.6	0.9
Sensitive plant ( <i>Mimosa pudica</i> ) . . . . .	13.7	6.8	6.9

urity, the plants were removed, weighed and analysed for nitrogen. Analyses of the soil for nitrogen were made before planting and after removing the crop. The nitrogen content was determined from the yield of freshly cut stems and leaves; the results are given in Table I.

It shows that a great deal of the nitrogen of the legumes had been obtained from the air and fixed by the root nodules. These data are only approximate because: 1) They are the average of a large number of pot experiments which do not exactly duplicate field conditions; 2) the amount of nitrogen in a given legume varies to some extent with different conditions of soil and climate. In the writers' experiments, the crops grown on poor soil were smaller than those on good soil, but the amounts of nitrogen calculated on the basis of a ton of fresh-cut leaves or stems was found to agree fairly closely for both soils.

In order to compare the amounts of nitrogen added to the soil by various legumes, the yields of the different legumes, and also the time necessary to mature a crop for green-manuring must be considered. Data on this subject are given in Table II. By this it is seen that *Crotalaria juncea*, *C. Saltiana* and *C. incana* are the legumes which most increase the nitrogen content of the soil.

TABLE II. — *Comparative Nitrogen Adding Values of Various Legumes grown as Green Manure.*

Variety	Estimated tonnage of fresh-cut stems and leaves per acre average	Approximate nitrogen content of total plant per ton of fresh-cut stems and leaves	Estimated nitrogen added to soil per acre by average crop turned under	Estimated time necessary to mature crop for green manure
	tons	lbs.	lbs.	months
<i>Crotalaria juncea</i> . . . . .	18	20.2	364	3
<i>Indigofera Anil</i> . . . . .	12	28.4	341	6
<i>Crotalaria Saltiana</i> . . . . .	14	23.5	329	3
<i>Crotalaria incana</i> . . . . .	17	18.9	321	3
<i>Vicia americana</i> . . . . .	14	20.0	280	5
<i>Canavalia ensiformis</i> . . . . .	16	16.3	261	5
<i>Stizolobium Deeringianum</i> . . . . .	18	14.0	252	4 $\frac{1}{2}$
<i>Soja Otolan</i> . . . . .	11	20.0	220	4
<i>Cassia Chamaecrista</i> . . . . .	8.5	23.7	201	3 $\frac{1}{2}$
<i>Vigna Catjang</i> . . . . .	15	12.1	182	3
<i>Vicia villosa</i> . . . . .	13	13.3	173	6
<i>Desmodium tortuosum</i> . . . . .	9	19.0	171	6
<i>Barchet Soya</i> . . . . .	8	21.2	170	4
<i>Desmodium uncinatum</i> . . . . .	7.5	19.8	149	3 $\frac{1}{2}$
<i>Sesbania aegyptiaca</i> . . . . .	12	11.4	137	4
<i>Lupinus luteus</i> . . . . .	15	8.7	131	3 $\frac{1}{2}$
<i>Phaseolus semierectus</i> . . . . .	6.5	17.3	112	3
<i>Phaseolus Mungo</i> . . . . .	7	15.5	109	3
<i>Dolichos biflorus</i> . . . . .	8	12.5	100	4 $\frac{1}{2}$
<i>Mimosa pudica</i> . . . . .	3	13.7	41	6



Of the legumes given in the tables, 7 occur commonly as weeds in Hawaii; of these the most important appear to be the wild "rattlepods" (*Crotalaria Saltiana* and *C. incana*). These plants grow wild and seem adapted to nearly every kind of soil and climate occurring in Hawaii. They are recommended by the writers as a green manure for pine-apples. They are also especially valuable for the manganese soils of Oahu, as being about the only legumes apparently uninjured by the black manganese soils. The chief objection to these wild rattlepods is the woody character of their stems. This woody character appears to the writers, however, as of considerable advantage in other ways under Hawaiian conditions, since rapid decay is there undesirable as the humus is soon "burnt out" of the soil (1). Of the other plants used in the experiment, *Indigofera Anil*, *Cassia Chamaecrista*, *Phaseolus semierectus*, *Desmodium uncinatum* and *Mimosa pudica* are also weeds in Hawaii.

1127 - **Studies of Leguminous Plants as Green Manure.** — GANGULEE, N., in *The Poona Agricultural College Magazine*, Vol. VIII, No. 3, pp. 141-156. Poona, 1917.

In India it has been repeatedly shown that the chief need of the growing crop which cannot be usually supplied from the soil is nitrogen. Therefore one of the principal problems of Indian agriculture is to maintain the nitrogen supply of the soil. The most natural and convenient source of this material is farmyard manure. If this manure is deficient, as it is in very many parts of India, the next resource is green manure composed of one or other of the many leguminous crops which occur in the country. The present article is a preliminary study of some aspects of nitrogen fixation in certain of the leguminous plants suitable for green manure, the conclusions reached being as follows:

1) *Dolichos Lablab* L. — Nodules commence to form on the root of this plant about fifteen days after germination, chiefly being concentrated on the larger roots. The smaller roots gradually become covered with nodules, except at the extremes of the rootlets. The nodules on the distal portions of the root gradually disappear after the plant is nearly full grown and only a few large nodules as large as a pea remain on the bigger roots. The nitrogen in the plant gradually increases from 0.21 per cent. in the dried seedling to 3.7 to 3.9 per cent. in the dried plant at the flowering stage. In these experiments the part above ground was always considerably richer in nitrogen than the roots.

2) *Cicer arietinum* L. — The progress of the nodules on the roots of this crop was curious. They were chiefly, though not exclusively, on the main roots. After the fifteenth to twentieth day from germination the large nodules on the main roots shrank, but numerous small ones on the finer roots

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(1) *Crotalaria Saltiana* is very vigorous. It grows as well in arid regions where the rainfall is less than 500 mm., as in very wet regions where the annual rainfall exceeds 5000 mm. The seeds germinate very quickly, the plants need no care. This species is attacked by no parasite, except the blue-butterfly, which simply reduces the number of pods. It is not suitable for forage. (*Report of the Hawaii Agricultural Experiment Station*, 1914, p. 21. Washington, 1915. (Ed.).

were formed. The nitrogen in the plant gradually increased from 0.23 per cent. in the dried plant just after germination, to 0.55 per cent. on the plant at the end of the seedling stage. The difference between the amount of nitrogen in the above-ground and the below-ground portions of the seedlings was very marked, the former containing as much as five or six times as much as the latter.

3) *Crotalaria juncea* L. — In the first series of experiments where only unhealthy plants were obtained which never grew beyond the seedling stage, nodules were first formed chiefly on the top root and afterwards tended to disappear. In the second series, where the plants remained healthy throughout, the nodules were found throughout the root system, and they seemed particularly luxuriant in presence of excess of phosphates. The amount of nitrogen rapidly increased during the growth of the plant, the maximum not being reached before full flowering. The most rapid increase took place between the eleventh and the twenty-fifth day of growth. The vigour of nitrogen accumulation seems almost equal with excess of phosphoric acid and with excess of lime, while excess of potash gives distinctly inferior results, except in the very early seedling stages.

4) *Phaseolus Mungo* L. var. *radiatus* Roxb. — In the second series of experiments with this crop, no nodules were formed until the seedlings were ten days old. Then, very small nodules first appeared on the plants with excess of potash and with excess of lime, almost entirely on the main roots. The number on the lateral roots then gradually increased, and in the most healthy plants they were found all over the root system of the flowering plants. The presence of excess of lime seemed to encourage the fixation of nitrogen and the development of nodules particularly, but almost equal results were obtained with excess of phosphoric acid.

1128 — Potassium Chloride from Mother Liquor in Manufacture of Sea-Salt. — NISHIMURA, T., in *Kogyo-Kwagaku-Zasshi*, Vol. XX, pp. 587-624, 1917; abstract in *Journal of the Society of Chemical Industry*, Vol. XXXVI, No. 19, p. 1046. London, October 15, 1917.

The annual production of bittern in Japan is 240 000 tons. When freshly obtained its composition is as follows:

Magnesium chloride . . . . .	12.27	—	20.63 %
Potassium chloride . . . . .	2.30	—	3.48
Magnesium bromide . . . . .	0.26	—	0.47
Magnesium sulphate . . . . .	6.04	—	7.62
Sodium chloride . . . . .	2.90	—	7.96
Water . . . . .	67.53	—	69.30

This bittern is considered one of the most important sources of potash in Japan. The isolation of the potassium chloride is described, by which 80 % of the potassium can be recovered as chloride of 80 % purity.

1129 — Seeds and Plants Imported into the United States. — FAIRCHILD, D. (Agricultural Explorer in Charge), in *U. S. Department of Agriculture, Bureau of Plant Industry, Inventory No. 38*, pp. 105 + X plates. Washington, 1917.

In this inventory are described the plants imported by the Office of Foreign Seed and Plant Introduction of the United States Department of

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Agriculture during the period January 1 to March 31, 1914. It includes Nos. 36 937 to 37 646, among which may be mentioned: —

Kerguelen cabbage (*Pringlea antiscorbutica* Brown), characterised by its dense white heart and taste resembling mustard and cress;

The "Liitou" (*Phaseolus aureus* Roxb.), used in China for the extraction of a starch used for laundry purposes, and which is superior to wheat or maize starch;

The Chinese chestnut (*Castanea mollissima* Blume), of which two superior fruiting varieties have been discovered which may prove valuable on account of their resistance to bark disease;

Certain varieties of Abyssinian flax which, like barleys of the same origin, may suit dry climates (California);

A perennial grass from India, *Ischaemum binatum* (Retz.) Buse, which may be used in the paper industry;

The Takuara bamboo of Paraguay (*Bambos guadua* Humb. and Bonpl.); Sorghum varieties from Africa;

A collection of cereals from the Tulun Experiment Station in Russia; Fruit varieties from Brazil;

The Sumatra Cassowary tree (*Casuarina sumatrana* Jungh.).

1130 — **Classification of the Indian and Far Eastern Species of the Genus *Strichnos*: Study from the Royal Botanic Gardeus, Kew, England.** — See No. 1165 of this *Review*.

1131 — **The Morphological Examination of Dog-Berries.** — GRIEBEL, C., in *Zeitschrift für Untersuchung der Nahrungs- und Genussmittel*, Vol. 34, Pt. 5, pp. 233-235, 2 figs. Berlin, September 1, 1917.

From the point of view of the utilisation of the fruit of the dog-wood (*Cornus mas* L.), the fleshy part as jam, and the kernel as a substitute for coffee, the author gives an anatomical description of it in order to ascertain its food value, especially as jam. It seems that the blue-black colouration of the tissues of the fruit, obtained by treatment with potassium hydrate solution, is characteristic of the dog-berry.

1132 — **A Chemical Study of the Seeds of *Hydnocarpus venenata*, *H. alcala* and *Pangium edule*.** — See No. 1166 of this *Review*.

1133 — **Environment of Seeds and Crop Production.** — HALSTED, BYRON, D. and OWEN, EARLE, J., in *The Plant World*, Vol. 20, No. 9, pp. 294-297. Baltimore, September, 1917.

The results of a series of experiments carried out at the New Jersey Agricultural Experiment Station at New Brunswick for the purpose of determining the effect which might be exercised on germination and early growth by placing seeds in different positions (1), and also the relative viability and vigour of seeds from different positions in the pod.

In all the experiments, seeds of the Scarlet Runner bean were employed. Only 3 positions of the seeds were tested: 1) laid flat; 2) with eye up;

(1) See on the same subject: ARTURO BRUTTINI, *Influenza della posizione dei semi nel terreno sulla durata della germinazione*, in *Stazioni sperimentali agrarie italiane*, Vol. XXXVIII, Part V-VI, pp. 466-469. Modena, 1905.



3) with the eye down. The depth of planting was uniformly 2 inches below the surface, and special care was taken to have the centre of gravity of each seed, however placed, level with the surface of the soil, after which a cover of fine earth was added, and the top of the bed brought to a level by means of a straight-edge. There were 6 plantings in duplicate, making 4050 seeds in all. At the same time, a test was made of the relative value of planting seed from pods with 2, 3 and 4 seeds respectively, and also of the bearing of the position of the seeds in the pod upon their viability and vigour.

All these tests were made during the period extending from November 21, 1916 to March 12, 1917. No record of the soil temperature was made during the first series, but it was comparable with that for the last one. It is noted that Scarlet Runner seeds are sensitive to the soil heat and their viability falls rapidly with the temperature; for example, from 92.9 per cent. in early December to 76.0 per cent. in February (18.1° C.), and rose again to 94.2 per cent. in March (21.5° C.).

The seedlings were harvested when they averaged near 300 mm. in length, the periods of growth ranging from 24 to 30 days. The averages for the time required for the seedling to reach the surface of the soil (emergence) are: flat, 12.54 days — eye up, 13.02 days — eye down, 12.8 days. Table I gives the general averages for all the seeds, and demonstrates that the greatest vigour is associated with the flat seeds, but that the hypocotyl is longest where the seeds are planted with the eye down. The loss of hypocotyl length is balanced by the longer first internode, so that the length from root juncture to the 2nd node is practically the same for all 3 soil positions, but after that point is passed, the seedlings from seeds planted with the eye up fall behind the others. Table II shows the relations of number of seeds and their position in the pod to weight, viability and vigour. The results, taken as a whole, indicate that the common practice of dropping seeds flat upon the soil is satisfactory. The comparatively smaller seeds when borne 2 in a pod are superior in viability and vigour, and the middle seeds from 3 and 4-seeded pods exceed all others in weight.

TABLE I — *Averages for the 3 positions in the soil.*

	Flat	Eye up	Eye down
Viability . . . . .	86.12 %	81.00 %	82.22 %
Vigour (green weight) . . . . .	8.98 grm	8.78 grm	8.74 grm
Hypocotyl . . . . .	12.54 mm	11.63 mm	12.96 mm
First internode . . . . .	137.17 "	137.60 "	136.88 "
Second internode . . . . .	97.43 "	93.20 "	96.71 "
Third internode . . . . .	46.80 "	35.80 "	49.56 "
Total length . . . . .	310.11 "	292.11 "	317.83 "

Both the number of seeds, and their position in the pod are environmental factors that influence the crop-producing value of the seeds. If the selection of seeds for planting is with pods only, the first choice is those

bearing 2 seeds. If only position in the pod is considered, the middle seeds are chosen, but if both pod and position are regarded, the tip seeds in 2-seeded pods are superior to all others, and the second choice is the third from the base in 4-seeded pods, followed closely by seeds from the other two middle positions.

The second seed from the base is always of high grade, and may be exceeded by the one next above, when the pod has 4 seeds.

TABLE II. — *Relations of number of seeds and their position in the pod to weight, viability and vigour.*

	Seed weight	Viability	Vigour (seedling weight)
2-Seeded: base . . . . .	0.847 grm	87.30 %	7.741 grm
2-Seeded: tip . . . . .	0.908	84.18	8.838
3-Seeded: base . . . . .	1.066	81.53	7.329
3-Seeded: middle . . . . .	1.171	87.51	7.960
3-Seeded: tip . . . . .	1.101	75.08	7.593
4-Seeded: base . . . . .	0.997	76.43	7.153
4-Seeded: first middle . . . . .	1.082	83.76	8.038
4-Seeded: second middle . . . . .	1.127	84.40	8.193
4-Seeded: tip . . . . .	1.107	83.73	7.764
<i>Pod averages.</i>			
2-Seeded . . . . .	0.928 grm	85.74 %	9.065 grm
3-Seeded . . . . .	1.115	81.37	7.627
4-Seeded . . . . .	1.078	82.08	7.408
<i>Position averages.</i>			
Base . . . . .	0.970 grm	81.75 %	7.408 grm
Middle . . . . .	1.138	84.08	8.038
Tip . . . . .	1.041	81.00	7.915

1134 — **Studies of the Phosphorus and Potassium Requirements of the Barley Plant During its Different Periods of Growth.** — PEMBER, F. R., in *Agricultural Experiment Station of the Rhode Island State College, Bulletin* 169, pp. 50, charts I-III, plates I-II. Kingston, R. I., U. S. A., 1917.

Experiments conducted with the intention of determining the actual requirements of barley plants for potassium and phosphorus during the different periods of growth, where most of the conditions essential to growth were under control. Barley plants were grown in sand (Wagner pots) and solutions, oats in soil (out of doors in sunken pots).

*Pot cultures.* — The test for the potassium requirement of the barley plant grown in sand was not continued after the first experiment because of the large growth the plants were able to make when no potassium was added. Plants growing in sand to which little or no potassium was added showed, however, spots or flecks of brown or rusty brown on their oldest leaves, the discoloration being the worst when no potassium was added.

Plants growing in sand to which no phosphorus was added were a dark-green and showed considerable purple in their stalks and leaves.

In four sand experiments the weight of the dry straw, or straw and roots, was much the same whether all of the phosphorus was added at the beginning and one-third at the end of the second period, or two-thirds at the beginning and one-third at the end of the second period.

In one experiment the amount of seed produced was much greater on the plants receiving their phosphorus in three equal applications instead of all at the beginning, but in another experiment plants having the full application of phosphorus at the beginning produced the most seed. Selected barley seed had a variable phosphorus content, but the weight of the whole dry plants grown from similar seeds bore no relation to the amount contained.

Plants grown for nineteen days from planting, with the full application of phosphorus at their disposal, were not markedly larger than those having only the one-third application of phosphorus, but the amount of phosphorus recovered from the former was more than double that from the latter. The amount of phosphorus recovered from the plants harvested at the end of the second period was much the same whether the full application of phosphorus was added at the beginning, or one-third at the beginning of each of the first and second periods. The best recovery of phosphorus by the barley plant grown in sand was about 89 per cent. of the amount added.

Oat plants grown in soil which received the full application of phosphorus before planting were larger and recovered more phosphorus than those which had three equal applications, but the amount of seed produced was in favour of the latter. In the following season it made little difference in the growth of the plants and the amount of phosphorus recovered whether the full amount was added at the beginning or in three equal applications. The best recovery of phosphorus by the oat plant grown in soil was one-fifteenth of the amount added.

*Solution cultures.* — Ten barley plants which received an average of 13 mgm. of phosphoric acid per week for the first ten weeks, absorbed nearly all of it. Plants receiving the maximum amount of phosphorus absorbed about 30 mgm. of phosphoric acid per week from the third to the sixth week, inclusive. The small application of phosphorus was sufficient for the needs of the plants, but their phosphorus content was much increased by the largest application.

Plants receiving minimum amounts of phosphorus for the first eight weeks of their growth were so handicapped that the effect was noticeable, not only in their size, but in the colour of their stems and leaves. Those receiving liberal amounts of phosphorus during the next four weeks made a rapid growth and appeared perfectly normal at harvest. The minimum amount of phosphorus required for ten plants having the optimum amount seed was about 75 mgm. phosphoric acid.

Plants grown in distilled water and receiving but 80 mgm. of potash did not mature seed, were limp and showed most markedly the characteristic brown spotting on their stems and leaves. Under similar conditions the amount of potassium recovered from the seed varied but little, regardless of the amount of potassium at the disposal of the plants, while the



amount obtained from the seed-free plants was influenced markedly by the amount added.

The amount of potassium, nitrogen or phosphorus absorbed by the plants was influenced greatly by the relation of the other nutrients.

Changes in the cultural methods, viz. aerating the solutions daily, keeping a piece of fresh charcoal in the solutions, or lowering the temperature of the solutions in summer weather, had no noticeable influence on the growth of the plants.

Titration of certain composite samples of the residual solutions showed but slight variations from the neutral point.

In the small quantities used, the addition of boron or manganese (44 mgm. and 110 mgm. respectively for ten plants) to the cultural medium had no apparent effect on the growth of the plants.

Results of tests made for potassium and phosphorus in distilled water in which plants were allowed to remain for from one to two weeks after they were full grown, did not substantiate the belief that either element was freely given off by way of the roots at maturity.

**1135 - Daily Variation of Water and Dry Matter in the Leaves of Maize and the Sorghums.** — MILLER, E. C., in *The Journal of Agricultural Research*, Vol. X, No. 1, pp. 11-45. Pl. 3. Washington, D. C., July 2, 1917.

In connection with a previous study of the water relations of maize and the nonsaccharine sorghums (1), it was thought advisable to determine the daily variation of the water and dry matter in the leaves of these plants. A knowledge of the variation of the water in the leaves should throw some light on the relative ability of these plants to absorb water from the soil and to transport it to regions of loss from transpiration, while a study of the daily variation of dry matter in the leaves would permit a comparison of the relative power of the plants to manufacture food under different climatic conditions. The experiments herein reported were conducted during the summers of 1914, 1915, and 1916 at the State branch Experiment Station at Garden City, Kansas, the variation of the water and dry matter in the leaves of maize and the sorghums being determined.

The plants used in these experiments were Pride of Saline corn (*Zea mays*), Blackhull kafir (*Andropogon sorghum*), and Dwarf milo (*A. sorghum*). In 1914 and 1915 the plants were grown in alternate rows on the same plot, while in 1916 the experiments were made with plants grown on a series of  $\frac{1}{20}$ -acre plots. The plants were grown in a sandy-loam soil that had been fall ploughed and irrigated with approximately 8 inches of water. The crops were surface-planted in rows 44 inches apart. After the plants were a few inches high the corn was thinned to a distance of 2 ft. between the plants, Blackhull kafir to 1  $\frac{1}{2}$  ft., and the Dwarf milo to 1 ft. The plots were hoed to keep the weeds down, but no other cul-

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(1). See MILLER, E. C., Comparative Study of the Root Systems and Leaf Areas of Maize and the Sorghums, in *Journ. Agric. Research*, Vol. 6, No. 9, pp. 311-332, 3 fig., pl. 38-44. 1916. Also Relative Water Requirement of Maize and the Sorghums, *ibid.*, Vol. 6, No. 13, pp. 473-484, 1 fig. pl. 70-72. 1916.

tivation was given during the growing season. They received no water after the fall irrigation, except that which came from the rainfall.

Four of the experiments in 1914 extended only through the daylight hours, but all the other experiments ranged in length from 24 to 48 hours. In these experiments the water and dry matter in the leaves were determined every two hours during 22 days and 10 nights for maize and milo and during 18 days and 10 nights for kafir.

The amount of water and dry matter in the leaves of a given variety of plant was obtained for any 2 hour period from 30 leaf samples, each with an area of 1 square centimeter. A single leaf on each of 30 representative plants furnished all the samples for an experiment extending over any desired length of time. From the results thus obtained, the amount of water and dry matter for each square meter of leaf, the percentage of water on a wet basis, and the percentage of water on a dry basis were calculated.

The amount of water in the leaves of milo was found to be much lower at all times of the day and night than that of either maize or kafir leaves at a like stage of development, while the average water content of the maize and kafir leaves at the same age was practically the same. The water content of the leaves of maize, kafir, and milo averaged 118.5, 120.0 and 107.0 gm., respectively, for each square meter of leaf during the day periods and, taken in the same order, 127.9, 132.7, and 115.5 gm. for the night periods. The average variation per sq. meter of leaf between the water content of the leaves during the day and night was 9.4 gm. for maize, 12.7 gm. for kafir, and 8.5 gm. for milo. The average variation between the maximum and minimum water content of the leaves from 7 a. m. to 7 p. m. was 13.8, 8.4 and 7.8 gm. for each sq. meter of leaf respectively for maize, kafir, and milo, while the average range between the maximum water content of the leaves during the night and the minimum amount during the day was 23.8 gm. for maize, 25.9 gm. for kafir, and 21.7 gm. for milo.

During the 22 days the evaporation as measured by a Livingston porous-cup atmometer reached a maximum 18 times between 2 and 3 p. m. and 4 times between 3 and 5 p. m. In two-thirds of the observations for maize and milo and in nine-tenths of the observations for kafir the minimum water content of the leaves under the conditions of these experiments occurred from two to four hours earlier than did the maximum evaporation as measured by the porous-cup atmometers. For the rest of the observations the minimum amount of leaf water occurred at the time of maximum evaporation.

The average variation between the maximum and minimum percentage of water in the leaves on a wet basis during the day from 7 a. m. to 7 p. m. was 3.5 for maize, 3.2 for kafir, and 4.5 for milo. On the same basis the average variation between the minimum percentage of water during the day and the maximum percentage during the night was 5.4, 5.9, and 6.0, respectively, for maize, kafir, and milo. The average difference between the minimum and maximum percentage of water on



a dry basis during the day from 7 a. m. to 7 p. m. was 39.5 for maize, 31.1 for kafir, and 35.9 for milo. The average range between the maximum and minimum water content on this basis during the night from 7 p. m. to 7 a. m. was 37.5, 47.5, and 40.0, respectively, for maize, kafir, and milo, while the average range between the minimum percentage of water on this basis during the day and the maximum percentage at night was 67.8 for maize, 67.2 for kafir, and 51.2 for milo.

The dry weight of a given area of milo leaf was always found to be greater than an equal area of either maize or kafir leaves at the same stage of development. The average dry weight of a square meter of leaf for all the observations made was 48.2 gm. for maize, 52.5 gm. for kafir, and 56.2 gm. for milo. The average difference between the minimum and maximum amount of dry matter in the leaves for each square meter of leaf from 7 a. m. to 7 p. m. was 4, 4.8, and 8.0 gm., respectively, for maize, kafir, and milo. The increase in dry matter began at daybreak and the maximum amount of dry matter in the leaves occurred in most cases between 2 and 5 p. m. The rate of increase of the dry matter in the leaves during the portion of the day when the climatic conditions were severe was much higher for milo than for either maize or kafir.

The results indicate that, under the conditions of these experiments the sorghums and, more particularly, milo can absorb water from the soil and transport it to the leaves more rapidly in proportion to the loss of water from the plant than can maize. As a result of this ability, the sorghums can produce more dry matter for each unit of leaf under severe climatic conditions than the corn plant.

The article contains a number of graphs and numerical tables illustrating the various points discussed.

1136 - **The Action of Certain Organic Substances in Plants.** — CIAMICIAN, G. and RAVENNA, C., in *Gazzetta chimica italiana*, Year XLVII, Pt. II, No. 3, pp. 99-107. Rome, August 31, 1917.

In a series of previous papers (1) the authors studied the action, in adult plants, of organic compounds inoculated in the solid state into the stem, or else absorbed by the roots. These two methods gave, in some cases indications, in others proof, that, by making plants absorb certain aromatic substances, the related glucosides form within the plants themselves. Thus, by inoculating saligenin into maize, salicine is obtained in the plant; by making the roots of beans absorb benzyl alcohol, and by inoculating it into maize, the formation of a glucoside, probably the benzyl glucoside, was observed; by inoculating into the thorn-apple and tobacco: pyridine, piperidine, carbopyrrollic acid, and, into tobacco alone: asparagine, ammonia, glucose and phthalic acid, the following was observed; "Pyridine

(1) *Memorie della R. Accademia di Bologna*, Series VI, Vol. 5, p. 29 (1907-1908); Series VI, Vol. 6, p. 129 (1908-1909); Series VI, Vol. 7, p. 143 (1909-1910); Series VI, Vol. 8, p. 47 (1910-1911); Series VI, Vol. 9, p. 71 (1911-1912); Series VI, Vol. 10, p. 143 (1912-1913); Series VII, Vol. 1, p. 339 (1913-1914). — *Rendiconti della R. Accademia dei Lincei*, Vol. XVIII, 1st. Half Year, p. 419 (1909); Vol. XVIII, 2nd. Half Year, p. 594 (1909); Vol. XX, 1st. Half Year p. 392 (1911); Vol. XX, 1st. Half Year, p. 614 (1911). (Author.)



has no specific influence on the increase of alkaloids ; in tobacco, the effect of ammonia is the same. The influence of asparagine is more remarkable ; it determined the greatest number of alkaloids. Wounding the plants also has the effect of increasing the nicotine ; it is, therefore, probable that, as a rule, a wound increases the alkaloid content of alkaloid plants in the same way as it increases the hydrocyanic acid in cyanogenetic plants. Glucose also causes a marked increase in nicotine ; in this respect the experiments on the formation of hydrocyanic acid are comparable with the present experiments. Finally, it should be noted that inoculation with phthalic acid caused a minimum percentage of alkaloids ( $\%$ ), so that there was very little difference between such plants and the control plants. If the influence of the lesion may be considered constant in all the cases studied, it may be said that phthalic acid decreases the amount of nicotine" (*Rendiconti della R. Accademia dei Lincei*, Vol. XX, 1st. Half Year, pp. 392-394 ; pp. 614-624 ; Rome, 1911).

The work summarised is the first of a new series of publications on germinating plants and vegetable enzymes. The authors proposed to study if the substances when inoculated into germinating seeds produced the same effect as on adult plants. For this purpose seeds of maize, wheat, bean, lupin and vetch were chosen and saligenin, hydroquinone, purocatechine, benzyl alcohol, gallic acid and tannin were tested. The following facts were observed among others, by making the roots of germinating maize and beans absorb saligenin, salicine is formed ; in the germinating seeds of maize and beans treated with benzyl alcohol, there are formed traces of a compound which, when heated with hydrochloric acid, gives benzyl alcohol ; in germinating beans watered with at  $1\%$  hydroquinone solution, is formed a compound, probably of a glucoside nature, similar to arbutine, which does not hydrolyse with emulsine, but separates out with sulphuric acid, heat, etc.

Finally, even in germinating plants which have to live on reserves, glucosides are formed in a similar way to when the substances are introduced into adult plants, either by inoculation or absorption by the roots.

If large quantities of substances are to be used, inoculation is the better method ; on the other hand, in experiments which do not require large quantities of the substances to be transformed it is preferable to water the germinating seeds with dilute solutions of the substance, because the matter to be examined is less cumbrous if the woody part is absent.

By using germinating plants it is easier to study the phenomena in the absence of light ; it was thus possible to observe the formation of salicine in the dark, which proves that light is not necessary to the genesis of glucosides. Moreover, the fact that salicine was formed in plants incapable of assimilation does not coincide with the theory of certain authors, according to whom glucosides are reserve materials because they are formed in plants which, growing in darkness, cannot contain an excess of glucose. This, however, does not imply that the aromatic substances occurring in plants either in the free state or as glucosides, should not be considered as waste matter. It seems more probably that the substances which appear accessory play some part, though, in most cases, its nature is still unknown.

1137 — **The Diastasic Degradation of Inulin in the Root of Chicory.** — WOLFF, J. and GESLIN, B., in *Comptes rendus des Séances de l'Académie des Sciences*, Vol. 165, No. 19, pp. 651-653. Paris, November 5, 1917.

It is pointed out that J. REYNOLDS GREEN was the first to study the transformation of inulin under the influence of diastases and that he was of opinion that *inulase*, a specific enzyme of inulin, transformed it into laevulose (1).

The authors have studied the disintegration products of inulin by the diastases which accompany it, giving preference to the root of chicory, one of the roots in which there is the greatest accumulation of inulin at the time of maturity. The results of their investigations show that the disintegration of inulin in the root under the influence of diastases is continuous and results in a *hexose*. The Authors call *inulids* the intermediate non-reducing products which form during this action.

These *inulids* (2) may be transformed into reducing sugar by the hydrolysing power of the juice itself. The most varied yeasts ferment it as easily as saccharose or maltose. Moreover, the use of various yeasts shows that there are inulids of unequal resistance which, by their different states of condensation, recall the various dextrines.

The hydrolysing action of chicory juice on the inulids contained in this juice is due to a diastase which seems to be identical with yeast sucrase. Although the hydrolysis of the inulids is slower, similar results are obtained by treating either inulids or a saccharose solution with an aqueous maceration of yeast or fresh chicory juice. On the contrary, neither the one nor the other have any action on pure inulins.

1138 — **The Acid Excretion of Roots.** — COUPIN, HENRI, in *Comptes rendus des Séances de l'Académie des Sciences*, Vol. 165, No. 17, pp. 564-566. Paris, October 22, 1917.

It is well known that at least some roots excrete an acid liquid capable of acting on the particles of the soil. Litmus paper is used to test this, but is too rough a method, for, either there is no contact between the paper and the root, or else the contact is so close that the root is injured.

In order to overcome these drawbacks the author devised a method which is extremely sensitive. One per cent, agar-agar (in spring water, weak nutritive solution) is coloured blue with litmus. A transparent jelly may thus be obtained which may be run into test-tubes, and in which young germinating plants take root well. In order to avoid bacterial action the tubes are sterilised in the autoclave, and only plants obtained aseptically by superficial sterilisation of the seeds which have been expanded in sterilised water and germinated on sterilised soaked cotton are used.

Before long the circumference of the root is surrounded by a pink band which gradually spreads all over the tube, showing the formation of an acid liquid, the nature of which (malic acid?) is not yet known.

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(1) Cf. J. REYNOLDS GREEN, *The Soluble Ferments and Fermentation*, p. 75. Cambridge, 1899. (2) TANCRET'S *synanthrine* certainly belongs to the "inulid" group. (Author).



Of the 26 seedlings tested by the author all gave a positive result. As they were chosen at random from among the principal biological types of plants, it seems reasonable to admit that *the formation of an acid liquid by roots is a general fact*, or, at least, very widespread, though at times reduced to traces.

The same experiments showed that *this acid formation begins as soon as the root emerges from the seed and continues till it dies*. In some cases, however, the excretion seems to stop early. The chief differences found between one root and another lies in the *intensity of the acidity* of the excretion, which is, moreover, demonstrated vaguely by the degree of the pink colour in the litmus jelly.

To complete these studies a further set of experiments was carried out placing a thick layer of the litmus jelly on glass and growing the roots on the surface in moist air. It was seen that, contrary to the statements generally accepted, the excretion is *not caused by the root hairs*, which always remain white, or, at the most, take on the blue colour of the litmus, but never turn pink. *The excretion really occurs in the superficial cells of the cortex*, in the zone covered by absorbant hairs, as well as in that which has not yet developed them (between the point and the hairy zone) and that which has lost them. It occurs both in the roots which, in the jelly, have absorbant hairs, and in those which have not.

It was also proved that *the formation of an acid liquid is particularly intense on the superficial parts of the cortex which have been injured and which then turn dark red*.

1139 — **The Selection of Lupins of Low Alkaloid Content, in Germany** (1). — ROEHMER, TH., in *Landwirtschaftlicher Jahrbuch*, Vol. I., pp. 433-444. Berlin, 1917.

PLANT  
BREEDING

In Germany the cultivation of lupins (*Lupinus luteus* and *L. angustifolius*) has not developed as much as it deserves to, in light soils, on account of the bitterness of the seeds and the toxic substances they frequently contain.

The author has investigated the possibility of decreasing, by selection, the amount of bitter substance contained by the seeds in order to avoid the long treatment required to free them from bitterness. In his experiments, carried out at Mahndorf in 1907, he adopted two methods: - 1) *hybridisation*: 2) *individual selection*.

1) *Hybridisation*. — Crossing the yellow lupin (*Lupinus luteus*) and the blue lupin (*L. angustifolius*) with other much less bitter species lead to no decrease in the bitterness of the seeds, as in the previous experiments by FRUWIRTH.

2) *Individual selection*. — Having observed marked individual differences in the alkaloid content of the direct descendants of *L. luteus* and *L. angustifolius*, the author isolated and propagated separately individuals with a low alkaloid content. At the same time he took into account all the morphological and anatomical characters capable of eventually facilitating

(1) See R. February 1917, No. 161.

(Ed.).



the work of selection by allowing special correlations to be discovered. In 1909 and 1910 he made careful observations and investigations, determining the alkaloid content by STEINER'S method, which, though not very exact has not yet been replaced.

In some lines the character "alkaloid content" appeared fixed and transmissible, plants with very bitter seeds producing descendants with the same character, and vice versa; but, in other lines, no transmissibility of this character was observed so that it is not yet proved. It may be that the individual differences observed are simple "fluctuations", of no value in selection.

**1140 - The Improvement of the Jute Crop by Pure Line Selection in British India. —**

FINLOW, R. S., in *The Agricultural Journal of India*, Vol. XII, Part II, pp. 283-290. Calcutta, 1917.

In the plantations of jute (*Corchorus capsularis* and *C. olitorius*), individual plants are frequently found which are distinguished by their taller stature and therefore — other things being equal — a corresponding greater yielding power than others.

In some cases, individual, pure line selection has shown that the characters of luxuriant growth and high fibre yield are fixed and transmissible to the offspring. By such selection was obtained, amongst others, a race called Kakya-Bombai of which, in 1917, sufficient seed was sold to sow 1500 acres. This race is much in demand on account of its productivity; at Dacca Farm, the highest yield was 34 maunds (nearly 7 bales) per acre. Recently, attention has been directed not only to the quantity, but also to the quality, of the fibre, and a careful chemical and microscopic examination of the fibres is made another basis for pure line culture.

It is necessary to combine in the same type, high yielding power and the maximum strength and durability of fibre. The writer hopes that ultimately this will be obtained by means of suitable hybridisation experiments.

**1141 - Variations in Young Sunflower (*Helianthus annuus*) Plants in Colorado. —**

TOCKERELL, T. D. A., in *The Journal of Heredity*. Vol. VIII, No. 8, pp. 361-362. 1 fig. Washington, August, 1917.

When cultivating new varieties of sunflower, the writer (Professor at the University of Colorado) had occasion to remark variations in the young plants. Thus the *coronatus* variety, which has ligulate flowers with chestnut-red tips, could always be distinguished, even when the seed had only just germinated, by the violet colour of the hypocotyl and of the cotyledons. The horticulturist can therefore at once select the young seedlings of this variety, and reject the others. On the other hand, it is impossible to distinguish the varieties with wine-coloured flowers.

The writer describes in detail 4 modifications of the cotyledons which he observed. The differences occur both in structure and colour. These characters are evidently hereditary, as are all the others, and their segregation would appear to occur according to Mendel's law. This is shown by the fact that there are as many normal types as variants, but no intermediate types. In Holland, DE VRIES obtained a strain of sunflower producing

seeds with united cotyledons, and though he was unable to isolate a pure line, he proved the hereditary nature of this character. The peculiarities displayed by these seedlings must thus be attributed to factors of germination, that is to say, to determinants which cannot be limited to the first period of growth, though their visible effects are confined to this period.

1142 — **The Improvement of Hops by Crossing and Selection.** — SALMON, E. S., in the *Journal of the Institute of Brewing*, Vol. XXIII, No. 2, pp. 60-82. London, 1917.

The results of a series of studies and experiments made of late years by the writer at the South-Eastern Agricultural College, Wye, Kent.

The characters of the hop plant which are of chief importance to the brewer are :

- 1) Aroma.
- 2) The resins content.
- 3) Fruitfulness.
- 4) Resistance to disease.

The effect of the environment : climate and soil, especially the latter, have an influence upon these characters, causing them to vary in degree and intensity, without, however, producing in any given variety, one or more of the characters peculiar to another. Thus, the resin content of the German hop Spätbayrischer, cultivated in England under the name "Late Bavarian", always remains higher than that of the English varieties, though it varies, within wide limits, according to its environment.

The above-mentioned 4 characters are "fixed" or "unit" characters, which there are scientific reasons for believing, could be combined separately in the hybrid plant.

**NATURE OF THE HOPS USED FOR THESE EXPERIMENTS.** — 1) *Aroma.* — As regards aroma, the English Golding variety is especially suited for making delicate flavoured pale ales ; the Fuggles variety can also be used for this purpose, but not Colgate. For the manufacture of Lager beer, (a beer containing little alcohol, but rich in extracts), no English hops are suitable, so recourse must be had to German varieties (especially Saaz), or to the French variety Bourgogne.

2) *Resin content.* — The percentage of resin over a period of 16 consecutive consecutive years (1898-1913) varies for English hops from 8.03 per cent. to 9.04 per cent. During a period of 6 years, the German variety Halletau produced the following percentages of resin : minimum, 9.29 per cent. ; maximum, 17.08 per cent ; average, 13.3 per cent. The German varieties Spätbayrischer, Elsass, and Auscha Grün, when grown in the United Kingdom, proved superior to the English varieties as regards resin content, but had the defects of producing little fruit and of not being resistant to disease and bad weather. The American hops are especially rich in resins (of which Oregon Cluster contains as much as 16.8 per cent.), but they are difficult to acclimatise in England. These data clearly show that the aim of selection should be to unite in a single type the aroma and resistance of the English hop with the high resin content characteristic of the American varieties.

The fact that the hop is dioecious is unfortunate from the selection point of view, since the seed characters transmitted by the male parent are



unknown. The combination of the good characters present in two female plants can only be obtained by indirect means, by discovering by special crossing experiments which sorts of male hops possess determinants of characters that will afterwards only appear in their female descendants.

Interesting results were obtained by crossing *Humulus Lupulus* (European) with *H. americanus* (United States). These varieties differ from one another in the shape of their leaf and cone, in resin content and the composition of their ethereal oil. The writer has made 2 series of experiments: —

1st. series. — Female hop plants of the Canterbury Whitebine (English) and Amos Early Bird (English) varieties, and also one German variety, were crossed with American male plants of Oregon Cluster, but the hybrids have not yet shown any commercial promise.

2nd. series. — A female hop of the American Oregon Cluster variety was fertilised by several male hops, chiefly English varieties. The offspring were *true hybrids* showing all kinds of combinations of different characters derived from the two parents: weak or vigorous plants; fruitful or unfruitful; compact cones resembling those of the English varieties; cones that resemble the loose, or open, American type; and cones which are of a new and hybrid character. As regards aroma, some individuals have the aroma of the best English varieties, others the black currant aroma peculiar to the American hop (but still more pronounced), while a few have a new aroma. In 4 of the hybrids, the resin content was respectively: 19.68 per cent.; 17.6 per cent; 15.7 per cent; 14.8 per cent.; that is to say, they were very rich in resin. Of these 4 hybrids, 2 had the aroma of Oregon Cluster, and the other 2 that of the English hop. In the latter therefore the chief aim of crossing was attained, namely the union in *one hybrid plant* of the aroma belonging to the best English types and the high resin-producing capacity of the American varieties.

At the present time, the writer has under observation between 3000 and 4000 hills. He is taking careful note of the aroma, resin content, cropping powers and resistance of these plants. It is not impossible that some of these individuals may show a greater combination of characters and that some new and valuable characters may appear as these hybrids attain maturity.

Further, the writer has collected at Wye, a very large number of varieties of hops from all parts of the world. Amongst these are wild hops from the United States which are distinguished by their resistance to disease and bad seasons — *Humulus neo-mexicanus* (wild in New Mexico) and *Humulus cordifolius* (indigenous in Japan). The increase in the number of bio-characters gives rise to more possible combinations and renders easier the task of the breeder who wishes to create a new type in which the 4 above-mentioned characters are united.

Scientific research with the object of improving the hop by selection has been undertaken in the following countries, as well as in England: Denmark (Carlsberg Laboratory, Copenhagen); Germany (especially at Weihestephan and Weissenberg); the United States.



1143 — Experiments in Crossing Varieties of Tomato in the United States. — JONES, DONALD, F., in *The American Naturalist*, Vol. LI, No. 610, pp. 608-621. New York, 1917.

The Quarter Century variety of tomato has a dwarf type of vine, red-coloured and more or less spherical fruits. Yellow Pear, on the other hand, has a standard or spreading vine, with yellow pear-shaped fruit. The 2 varieties thus differ in 3 characters.

The  $F_1$  plants grown from the cross of these 2 varieties were standard in habit of vine (dominant character); with red fruit, which differed in shape from that of either parent, being oval rather than spherical, but more like the fruit of Quarter Century than that borne by Yellow Pear (incomplete dominance).

In the  $F_2$  were obtained, as is easily foreseen, 3 distinct groups of individuals: 1) similar to Quarter Century; 2) similar to Yellow Pear; 3) with intermediate characters, that is to say, true hybrids. The 2 first groups have the same gametic formulae as their parents (*ascending combinations*), whereas the third group shows *new combinations*. The latter occur in *smaller numbers* than was expected, but the groups similar to their parents were found in *larger numbers* than had been predicted. The deviations above and below the expectancies are about the same in both red-fruited and yellow-fruited plants, which indicates that fruit colour is an independent factor, and need not therefore be taken into consideration.

Table I gives the most important data respecting the composition of the  $F_2$  as regards growth habit and shape of fruit. The forms of the fruit are distinguished by the writer as pyriform, and not pyriiform, the latter including the oval fruits of the  $F_1$  and the spheroidal fruits of the Quarter Century variety.

TABLE I. — *Combinations of the Characters of Growth Habit and Fruit Shape in the  $F_2$ .*

Gametic Formula	Characters of hybrids of the $F_1$	Number of individuals found	Number of individuals expected	Combination of Characters
A B	Standard vine — fruit not pyriform.	252	284	New combination.
A b	Standard vine — fruit pyriform. . .	127	95	Parental (ascendant) combination.
a B	Dwarf vine — fruit not pyriform . .	121	95	Parental (ascendant) combination.
a b	Dwarf vine — fruit pyriform . . . .	3	31	New combination.

These figures clearly bring out the fact that the parental combinations are in excess. The writer explains this phenomenon very satisfactorily by means of BATESON'S theory of "spurious allelomorphism". The hybrids of  $F_1$ , which have the gametic formula  $AbBb$  (where  $aB$  represents the Quarter Century parent, and  $Ab$  the Yellow Pear parent), produce 4 types of gametes:  $AB - Ab - aB - ab$  — in the ratio of  $1 AB : 4 Ab : 4 aB : 1 ab$

(the normal proportion would be 1 AB : 1 Ab : 1 aB : 1 ab). If this explanation is admitted, the agreement between the expected values and those found is very satisfactory, as is shown by the following figures:

	AB	Ab	aB	ab
Number of individuals found, . . . . .	252	127	121	5
Actual ratio . . . . .	50.4	25.4	24.2	1
Theoretical ratio . . . . .	51	24	24	1

The above mentioned anomaly occurs only in the pair of characters, "growth habit" and "fruit shape". As regards the pairs of characters, growth habit and fruit colour, or fruit colour and fruit shape, no excess is observed in the parental (ascendant) variation. Table II sets forth the data referring to the combinations of this last pair in the  $F_2$ .

TABLE II. — *Combinations of the Characters "Fruit Colour" and "Fruit Shape" in the  $F_2$ .*

Genetic Formulae	Characters of $F_2$ plants	Number of individuals found	Number of individuals expected	Combination of Characters
AB	red fruit, not pyriform . . . . .	289	284	Parental combination
Ab	yellow fruit, not pyriform . . . . .	84	95	New combination
aB	red fruit, pyriform . . . . .	101	95	New combination
ab	yellow fruit, pyriform . . . . .	31	31	Parental combination

The figures in Table II are easily explained, if we allow that the various gametes are produced in equal proportions. In conclusion, the writer makes a long critical examination of the Mendelian characters hitherto discovered and studied in the tomato. He bases his observations partly on data recorded by other investigators, and partly on the results of his own experiments. There would appear to be in all 11 pairs of allelomorphs and these are given in Table III.

TABLE III. — *Pairs of Allelomorphs in the Tomato.*

		Dominant	Recessive
Fruit shape. . . . .	1	Spherical	Pyriform
Fruit shape. . . . .	2	Roundish, conical	Roundish, compressed
Loculation of ovary, . . . . .	3	Bilocular	Plurilocular
Endocarp colour. . . . .	4	Red	Yellow
Epicarp colour . . . . .	5	Yellow	Colourless
Fruit surface . . . . .	6	Smooth	Pubescent
Vine habit and leaf surface . . . . .	7	Standard	Dwarf
Leaf margin . . . . .	8	Serrate	Rugose
Leaf type . . . . .	9	<i>Pimpinellifolium</i> type	Entire
Foliage colour . . . . .	10	Green	<i>Esculentum</i> type
Inflorescence type . . . . .	11	Simple	Yellow
			Compound

We have thus obtained values which are by no means fixed, but which may, in the course of the experiments, give rise to new conceptions. For the moment however, they show real progress and agree well with the modern theories of heredity and the behaviour of chromosomes. The fruit colour, which preceding investigators considered to depend upon 4 pairs of allelomorphs, depends in the writers' opinion, upon 2 pairs only.

Different combinations of skin colours and flesh colours give the different coloured fruits. For example, colourless epicarp over red endocarp gives pink-coloured fruit.

1144 — **Sugar Beet Seeds, in France.** — SAILLARD, EMILE, in *Comptes rendus des Séances de l'Académie des Sciences*, Vol. 165, No. 16, pp. 508-510. Paris, October 15, 1917.

AGRICULTURAL  
SEEDS

Before the war, over 10 million pounds of sugar beet seeds were used annually in France;  $\frac{4}{5}$  ths. of these came from abroad, especially from Germany.

During the 10 years 1904-1913, the author carried out cultural experiments with a view to comparing the French varieties with the best German varieties. In 1915 he came to the following conclusions (1): "In 1905, the best French varieties produced less sugar per acre (about 125 lbs. less) and had a lower sugar content (0.9 % less). At the present time they yield as much, and sometimes more, sugar per acre and are not more than 0.3 to 0.4 % inferior in sugar content. It is, therefore, possible to produce in France seeds equal to those which came from Germany".

In 1916 and 1917, practically only Russian and French seed was used in France, particularly Russian seed.

Owing to lack of labour the author has been unable to continue his comparative experiments, but has continued to follow the development of the beet harvest, as he has done every year since 1901. He summarises the results of his studies as follows:

1) Sugar beets have been practically as rich in 1916 and 1917 as in the 10 years previous to the war. The yield of sugar per acre has, perhaps, been a little lower, but it should be noted that cultural conditions have been less favourable owing to the insufficiency of manuring and tillage, both applied too late.

2) During the 10 years (1904-1913), the sugar content per week, per acre or per root was highest at the beginning of September (507  $\frac{1}{2}$  lbs. per acre, 7.95 grammes per root). During the two years 1916 and 1917, this maximum was a little later.

The figures quoted refer to good crops and exceed the current averages.

1145 — **The Cultivation of Wheat by Early Sowing and Hilling-up** (2). — DEVAUX, H., in *Comptes rendus des Séances de l'Académie d'Agriculture de France*, Vol. 3, No. 31, pp. 910-913. Paris, October 17, 1917.

CEREAL  
AND PULSE  
CROPS

The author (professor in the Faculty of Science at Bordeaux) describes the results of his latest experiments on the cultivation of wheat by the method

(1) E. SAILLARD, *Journal d'Agriculture pratique*, July 1, 1915, and *Rapport sur les Essais culturaux faits sur les graines de betteraves à sucre*, published in 1915. (Author).

(2) See R. May, 1917, No. 428 and R. October, 1917, No. 914. (Ed.)



advocated by him. In January, 1917, he showed at the Academy wheat showing a very fine start; magnificent clumps had been obtained by early sowing, followed by hilling up, and there was very reason to hope that the wheats would give high yields although the soil was only medium. As a matter of fact the yields were only average, as growth did not show the same progress after the winter as it had shown before.. The yields in cwt. per acre were as follows:

		Grain	Straw
Bordeaux	(sown August 19) . . . . .	10.80	29.15
Bearded Rieti	( " " " ) . . . . .	11.62	26.97
Bon Fermier	( " " 23) . . . . .	13.26	27.38
Hybride inversable	( " September 23) . . . . .	14.22	29.13

These yields would be very mediocre in the north of France, but they are interesting for the district in which they were obtained, and considering the soil of the experimental plots (moorland, sandy and stony, burning hot in summer, to which no fertiliser had been given except small quantities of farmyard manure), the very bad climatic conditions prevailing everywhere in 1917, and the average yield of wheat of 10 cwt. per acre which fell in 1916 to 8  $\frac{1}{2}$  or 9  $\frac{1}{2}$  cwt., and which, in 1917 is much below 8 or even probably 6 cwt. in bad soils.

There is, therefore, an increase in yield amounting to from 4 to 8 cwt. per acre.

The results obtained led to the following conclusions: The experiments made with wheat at Bordeaux by early sowing followed by hilling-up, although prevented for several reasons from giving the excellent results which might legitimately have been expected from them, gave a marked increase in yield.

The author quoted the experiments of Mr. RËY carried out simultaneously with his on excellent soil in the Department of Lot, which gave the following yields:

Seed sown on September 28 . . . . .	48 $\frac{1}{2}$ cwt. per acre
" " " November 3 . . . . .	24 $\frac{1}{2}$ " " "

It is seen here that early sowing had an extraordinary effect on the yield, for the difference in yield obtained in the same soil and by the same methods can only be attributed to the date of sowing.

#### 1146 - Cultural Experiments with Different Varieties of Wheat at Ultuna, Sweden. —

NILSSON, GEORGE, in *Sveriges Utsädesförenings Tidskrift*, Year XXVII, Pt. 3, pp. 122-135, IX tables, 1 diagram. Malmö, 1917.

This paper gives the results of cultural experiments made in 1916 at Ultuna (Central Sweden) with 15 varieties of winter wheat and 6 varieties of spring wheat.

WINTER WHEATS. — All the varieties, including the most delicate and most productive ones, resisted the winter perfectly and when, after the middle of March, the snow had disappeared, all the fields were in excellent condition. From April onwards, however, the continuous rains, then the heavy

downpours, greatly damaged the cereals by causing rust and lodging, so that the *quality of the grain* was below the average. The weight per hectolitre (1) and the weight of 1000 grains varied as follows:

Variety	Weight per hectolitre (1)		Weight of 1000 grains	
	minimum	maximum	minimum	maximum
0750 Latorp pedigree . . . . .	67.8 kg	—	25.7 grm	—
Sol (original of Svalöf) . . . . .	—	73.5 kg	—	37.25 grm

As for *yield in grain* the best results were given by the varieties which were resistant to rust and lodging: Sol II, which gave 3933 kg. of grain and Sol, which gave 3808 kg. In 1916 the Thule II variety only occupied the 3rd. place, with a yield of 3458 kg.; on the other hand, throughout the period 1911-1915 the "Thule" type (represented by 0826 Thule III) lead with 3446 kg. of grain, thanks to its resistance to cold, which enabled it to do well, even in 1915, after an exceedingly hard winter, which greatly damaged the other varieties of wheat, almost entirely destroying the Bore, Sol and Weibulls Iduna varieties. The native wheats, whose sole positive character is their resistance to cold, whereas they are very susceptible to rust and lodging, gave very bad results in 1916. Only the line 0760 of native Wärmland wheat gave a grain yield of 3042 kg., but little inferior to that of the selected types; this is probably attributable to the strength of its culms.

SPRING WHEATS. — In 1916 these gave the following results:

Variety	Yield per hectare (2)		Weight of 1000 grains	Weight per hectolitre	Duration of vegetative period	Grain yield compared with that of Kolben per cent.
	Grain	Straw				
	kg.	kg.	grm.	kg.	days	
0702 Kolben of Svalöf . . . . .	2 243	6 233	29.23	68.4	141	100.0
0821 of Värpäril × Kolben . . . . .	2 287	6 982	31.78	66.8	143	102.0
0841 of 0201 × Kolben . . . . .	2 664	6 882	31.33	66.2	141	118.8
0880 of Kolben × 0740 . . . . .	2 269	5 339	31.08	70.2	131	98.5
Dalarne native . . . . .	1 732	4 429	28.40	71.4	120	77.2
Halland native . . . . .	1 721	4 440	27.80	70.9	130	76.7

In 1916, complete maturity was attained only by the two native varieties, and the line 0880 of the hybrid Kolben × 0740 (0740 = selected line of Dalarne native wheat).

The maximum yield in grain (2664 kg. per hectare) was given by line 0841 of the hybrid 0201 × Kolben, but lack of maturity greatly diminished the quality of the grain.

(1) 1 hectolitre = 2.751 imperial bushels.

(2) 1 hectare = 2.471 acres.

(Ed.)



These results show the necessity of continuing the work of hybridisation and selection in order to combine better the earliness of the native types with the productivity of the ultra-selected types. The hybrid Kolben X 0740, line 0880, already shows marked progress in this direction, with an earliness but little inferior to that of the native stock plant and a yield exceeding that of Dalarne spring wheat ("Dalarne Lantvärvete") by 20 %.

On the other hand, taking into consideration the possibility of ultimate improvements it still remains to be seen if wheat is the most profitable spring cereal and whether, on the contrary, oats or barley would not be more satisfactory. The data of the period 1907-1916 with regard to Kolben spring wheat and the common native wheat of Central Sweden, to Fyris, Seger, Guldregn and Klock II oats, and to Primus and Gullkorn barleys, are unfavourable to spring wheats. Barley gave 1224 kg. (74 %) more grain per hectare than the spring wheats, and oats 1099 kg. (67.1 %) more. As for the yield in straw, the averages for 10 years were: spring wheat, 3642 kg.; barley, 3886 kg., oats, 4076 kg. per hectare. These results are certainly partly due to the shorter vegetative period of oats and barley, which enable them to answer better to the climatic conditions of central Sweden. The earliest native spring wheats only ripen, on an average, one week after Seger oats and Gullkorn barley. The duration of the vegetative period during the years 1907-1916 is given below.

	Minimum duration	Maximum duration	Average duration
Kolben wheat. . . . .	108 days (1911)	151 days (1907)	131 days
Native spring wheat . . . . .	101 " (1911)	134 " (1907)	120 "
Seger oats . . . . .	95 " (1911)	128 " (1907)	112 "
Gullkorn barley . . . . .	96 " (1911)	128 " (1916)	111 "

1147 - Cultural Experiments with Different Varieties of Wheat at the Östergötland Agricultural Experiment Station, Sweden. — SUNDELIN, GUSTAV, in *Sveriges Utsädesföreningars Tidskrift*, Year XXVII, Pt. 3, pp. 136-153. Malmö, 1917.

The productivity of a cultivated variety of wheat depends: 1) on its anatomical structure, which, in the organic equilibrium of the plant, may favour the development of the grain in varying degrees; 2) on its resistance to disease and unfavourable environmental conditions, especially meteorological ones. When this specific resistance is absent, a plant which by its nature is productive, may be a complete failure when adverse conditions are present to a marked extent. The results obtained from cultural experiments in one district cannot, therefore, be applied to others in which the soil and climate are different. Thus, the Extra Squarehead II variety, which is excellent for Svalöf, gave very bad results when sown in Östergötland in 1915 because of its slight resistance to cold, for, if this resistance is negligible in the extreme south, it is essential in central Sweden, where the winter is much longer and much more severe. For similar reasons the productivity of a variety cannot be based on the results obtained in one year, which might be either too favourable or too unfavourable. Such judgment would lead to conclusions which would be inexact, if not false. The Östergötland



Station was established with the aim of testing thoroughly in central Sweden plants created at Svalöf, or those derived from them, and, at the same time, to start experiments in order to obtain the types best adapted to the particular agronomic and climatic conditions of the district.

The paper gives the results obtained during the first 3 years, 1914-1916, with winter and spring wheats, oats, barley, rye, Leguminosae, sugar beets and mangolds. The data bearing on winter wheats are particularly interesting. The following 19 varieties were tested.: — Extra Squarehead II, Sol, Sol II, 0912 (from the hybrid Sol  $\times$  Extra Squarehead II), Tystofte Smaahvede, Fylgia, 0863 and 0865 (from Smaahvede  $\times$  Extra Squarehead II), Pansar, Pansar II, Weibulls Iduna, Renodlad Squarehead, 0840 (from Grenadier  $\times$  Bore), Bore, Pudel, Thule, 0823 and 0825 (from Pudel  $\times$  native Swedish), native Swedish. In order to do well in Östergötland, wheat must be immune to rust, have strong, elastic culms, little apt to lodge, and be resistant to cold.

1) *Rust*. — The first place is held by Pansar, which, in this respect, is almost entirely immune. Then come Tystofte Smaahvede, Fylgia and 0.865 (from Smaahvede  $\times$  Extra Squarehead II), which are also highly immune. On the other hand, the native types ("Svenskt lanthvete") and Renodlad Squarehead, as well as Extra-Squarehead II, suffered greatly from rust.

2) *Resistance to cold*. — 0912 (from Sol and Extra-Squarehead II), 0823 and 0825 (from Pudel  $\times$  native Swedish) proved very resistant. Tystofte Smaahvede, Pansar and Bore, on the contrary, resisted cold badly. The other varieties were intermediate

3) *Resistance to lodging*. — Extra-Squarehead II, Pansar and Bore were distinguished by the strength and elasticity of their culms. Sol, Fylgia, Weibulls Iduna, Pudel and native Swedish wheat lodge easily. The other varieties are intermediate.

4) *Grain yield*. — On the averages of the 3 years 1914-1916, Sol II holds the first place with 34.05 cwt. per acre, or 10 % more than Sol, which has a yield of 30.96 cwt. and 20 % more than the native Swedish wheat, which yields 26.47 cwt. Then follow Pansar, with 32.74 cwt. and Thule II (0825 from Pudel  $\times$  native Swedish) with 32.06 cwt.

Among the new varieties, tested only during the two years 1915-1916, mention should be made of 0912 (from Sol  $\times$  Extra Squarehead II), on account of its immunity to rust, its earliness, resistance to cold (superior to that of the parent plants), and its high yield, 34.96 cwt. per acre, that is to say, 13 % more than Sol and 43.1 % more than native Swedish wheat. Two years are not sufficient to give a definite opinion, but, if subsequent experiments confirm the results already obtained, the variety 0912 is the wheat best adapted, not only to Östergötland, but also to Westergötland, Kalmar and Gotland.

1148 — *Red Fife Wheat in the South-West of France*. — PÉRICHON, A., in the *Journal d'Agriculture pratique*, Year 81, New Series, Vol. 20, No. 22, pp. 426-427. Paris, November 1, 1917.

Every year in the south-west of France occurs the phenomenon known

as "*coup de soleil*" (sunstroke). At the beginning of summer, a short, fine rainfall, or even only a mist, is followed by every strong sunshine. From that moment all the wheat fades more or less, particularly that which was progressing best.

The author thought that Red Fife wheat, a native of Scotland, where mists are frequent, might resist the sunstroke. During 15 years he experimented with a Red Fife wheat from the firm of VILMORIN, and the results showed that it is more resistant to sunstroke than many other varieties, particularly "*Rouge de Bordeaux*", which is widely grown in the district in which the tests were made.

**1149 — The Most Favourable Times for Sowing Wheat and Rye at Alnarp, Sweden. —**

FORSBERG, L., in *Tidskrift för Landtmän*, Year 38, No. 35, pp. 583-389. Lund, 1917.

The author gives the results of experiments carried out at the Alnarp Agricultural Station, to determine the most favourable time for sowing wheat and rye.

**WHEAT.** — Varieties tested: — "*Extra Squarehead*", during the period 1912-1915, then "*Pansar*" in 1916 and 1917. Dates of sowing: 2nd., 16th. and 30th. September. During the 6 years, 1912-1917, the following average yields of grain and straw were obtained:

	Date of sowing		
	Sept. 2	Sept. 16	Sept. 30
Yield in grain per acre. . . . .	27 cwt.	33 cwt.	29 cwt.
Yield in straw per acre . . . . .	43 "	51 "	42 "

During 4 years out of the 6, sowing on the 16th. September gave better yields both in grain and straw. In 1915 and especially in 1917, sowing on the 2nd. September gave good results, exceeding that of the 16th. September by 22 % in grain yield and 33 % in straw yield. On the other hand, late sowing (30th. September; 14th. October in 1916 and 1917) always gave inferior results.

These data show that, at Alnarp, the most favourable time for sowing wheat is towards mid-September. This, naturally, varies for other agronomic and climatic conditions; for example, in places higher and colder than Alnarp, the best date is from the 5th. to the 10th. of September, whereas, in Skåne (southern Sweden), the most satisfactory time for sowing is at the end of September or during the first half of October.

**RYE.** — Variety tested: — "*Stjärnråg*". Dates of sowing: — 2nd., 16th., 30th. September and 14th. October.

The following table shows the yields in grain and straw obtained during the 4 years 1914-1917.

	Date of sowing			
	2nd. Sept.	16th. Sept.	30th. Sept.	14th. Oct.
Yield in grain per acre	36 cwt.	33 cwt.	31 cwt.	26 cwt.
Yield in straw per acre	61 "	59 "	52 "	40 "

The most favourable date for sowing rye is, therefore, the 2nd September. The yields in grain and straw decrease with the lateness of sowing, until, for the 14th October, they reach a minimum of 26 and 40 cwt. respectively.

The date of sowing influences the quality of the crop, both in the case of wheat and in that of rye.

Experiments to determine the most favourable time for sowing in the various districts would, therefore, be of great value.

**1150 — Cultural Experiments with Different Varieties of Oats in Norway.** — KNUT, WIK, in *27de Aarsberetning (for 1915-1916) om Norges landbrukshøiskoles Akerceksforsøk*, Christiania, 1917.

This paper gives the results of cultural experiments made in 1915 and 1916 with 40 varieties of oats, amongst which were largely represented the best types created at Svalöf, which have rapidly spread throughout the Scandinavian countries. These are: — Guldregn, Kron, Leger, Ligowo II, Dala, Klock I, and Klock II, Stormogul, etc. Then come: — Grenadier, Odin and Thor, Norwegian varieties produced by W. CRISTIE, two Danish varieties, Tystofte Gulvid and Gul Naesgaard; and the varieties Strubes, Schlanstedter, Waverley, Storm King, Tartar King, as well as the native local varieties.

*Grain yield.* — Klock II gave the best results in this respect, but the fact that it is black is prejudicial to it in Norway, where white or yellow oats are grown exclusively.

There are better prospects for Guldregn, a white oat, whose 2nd. place in grain yield has been confirmed by the experience of many years and more than 200 cultural experiments.

1 The varieties Leger and Kron also give a good grain yield but are too late to be grown advantageously in Norway.

*Straw yield.* — In this respect Stormogul is superior to all the other varieties and is the best type of fodder oats.

The Norwegian varieties, Odin and Grenadier may compete with Guldregn, but only in very favourable environmental conditions.

The Thor variety, remarkable for its earliness, gives a higher yield than the native varieties, which it might, perhaps, replace.

The Danish oats, Tystofte Gulvid and Gul Naesgaard are, on the average, inferior to the Guldregn variety.

**1151 — Varieties of Maize for Grain and Green Fodder Recommended by the Department of Agriculture for New South Wales.** — *The Agricultural Gazette of New South Wales*, Vol. XXVIII, No. 8, pp. 559-562. Sydney, August 1917.

A conference of Inspectors of Agriculture was held in Sydney lately for the purpose of discussing the work in connection with the Farmer's Experiment Plots. The following recommendations (see p. 1219) were made for the growing of maize throughout the State:



*Summary of the recommendations.*

Variety	Use	District and Time of Sowing
Boone County White . . .	Grain	South Coast (for main crop, October sowing, and for rich soils or for low moist situation).
Early Clarence . . . . .	Grain	Tumut District.
Early Yellow Dent . . .	Grain	Northern Tableland, North-Western Slopes (for December sowing if necessary), Western Slopes (only September or December sowings recommended).
Funk's Yellow Dent . . .	Grain	South Coast (for early crop, September to November sowing), Central Tableland, North Western Slopes (for October or November sowing), Western Slopes (only September and November sowings recommended), Tumut district, Murrumbidgee Irrigation Area (only December sowing recommended).
Hickory King . . . . .	Grain	North Coast (on poorer or upland soils), Central Coast (for poorer or upland soils), South Coast (for early crop, September to November sowing, and for poorer or upland soils).
	Green Fodder	South Coast (for poorer or upland soils), Northern Tableland, Southern Tableland (for early maturing crop).
Improved Yellow Dent. .	Grain	North Coast (for late sowing or main crop, October to December sowing), Central Coast (main crop, October to December sowing), South Coast (main crop, October sowing).
	Green Fodder	North Coast, Central Coast, South Coast (for fertile soils), Southern Tableland (for late maturing crop), North Western Slopes, Western Slopes, Tumut district, Murrumbidgee Irrig. Area.
Leaming . . . . .	Grain	North Coast (most suitable for early sowing, September to November), North Coast (Dorrigo and Comboyne Tablelands), Central Coast (for early crop, September and October sowing), Tumut district.
	Green Fodder	Northern, Central and Southern Tableland (for early maturing crop), Western Slopes.
Red Hogan. . . . .	Grain	Central Coast (main crops, September to November sowing), South Coast (main crop, October sowing.)
Reid's Yellow Dent . . .	Grain	North Coast (Dorrigo and Camboyne Tablelands).
Silvermine . . . . .	Grain	South Coast (for early crop, September to November sowing), Central Tableland Western Slopes (only September or December sowings recommended), Murrumbidgee Irrigation Area (only December sowing recommended).

*Approximate Order of Maturity,  
of the varieties recommended by the Department :*

Early . . . . .	Early Yellow Dent
Medium Early . . . . .	Silvermine
	Funk's Yellow Dent
	Reid's Yellow Dent
Mid Season. . . . .	Hickory King
	Boone County White
	Leaming
Medium Late . . . . .	Early Clarence
	Improved Yellow Dent
Late. . . . .	Red Hogan

The maize districts for the purpose of these recommendations were classified as follows: North, Central and South Coast, Northern, Central and Southern Tableland; Northwestern and Western Slopes, Tumut District and Marrumbidgee Irrigation Area.

The following varieties are being further tested by the Department :

Gold Standard Leaming	Hildreth
Goldmine	Hiawatha
Yellow Moruya	• Kansas Sunflower
Giant White	Whitecap Horsetooth
Yellow Mastodon	Prairie Queen
Golden Nugget	Chester County

The recommendations are summarised on page 1218.

1152 — **Maize Growing in Utah, U. S. A.: Irrigation and Manuring.** — See No. 1125 of this Review.

1153 — **Effect of Removing Blossom on Yield of Potatoes.** — *The Gardeners' Chronicle*, Vol. LXII, No. 1610, p. 178. London, November 3, 1917.

STARCH CROPS

Among the experiments carried out during the present year by Messrs. Sutton & Sons at Reading, those relating to the effect of the removal of the blossoms on the yield of potatoes are of special interest.

The following table gives the results in detail and from it will be seen that, in five out of seven plots experimented upon, picking of the blossoms resulted in an increased yield, and that the average increase was by no means negligible, amounting to 215 lbs. or an increase of 5 per cent.

*Blossoms Picked v. Not Picked.*

	Picked			Not Picked		
	cwt.	qr.	lbs.	cwt.	qr.	lbs.
Plot 2 . . . . .	4	2	4	5	0	3
Plot 4 . . . . .	5	2	10	4	2	1
Plot 6 . . . . .	5	3	0	5	0	20 ½
Plot 8 . . . . .	5	2	9	5	0	7
Plot 10. . . . .	4	2	20	4	1	26
Plot 12. . . . .	5	2	20	5	1	8
Plot 14. . . . .	4	3	4	5	0	10

1154 - "Capim jaraguá" (*Andropogon rufus*, Kunth), a Brazilian Fodder Plant. — CORRÊA, M. P., in *Lavoura e Criação*, Year 2, No. 2, pp. 28-30. Rio de Janeiro, February, 1917.

This grass, whose roots are almost rhizomes, whose stem reaches a height of nearly 10 feet and whose narrow leaves reach a length of 6 ½ feet, is perennial and early even during the rainy season. It is resistant to heavy and continuous rains, to intense heat and, sometimes, even to slight frosts, but cold is very detrimental to it, and may even destroy it entirely.

In central Brazil (Piauhy, Goyaz and Matto Grosso) it is one of the principal fodder plants, and might, perhaps, be advantageously grown from São Paulo to the extreme north; it has even been introduced into

*Analysis of the grass and hay of Andropogon rufus.*

	Before flowering	In flower	After flowering
<i>Grass:</i>			
Water . . . . .	72.80 - 77.91 %	72.85 %	65.61 %
Nitrogen . . . . .	1.29 - 2.75	1.61	1.09
Fat . . . . .	0.46 - 0.86	0.33	0.40
Nitrogen-free extract . . . . .	9.56 - 9.75	10.78	14.83
Fibre . . . . .	8.00 - 9.50	11.22	14.50
Ash . . . . .	2.59 - 4.53	3.21	3.57
<i>Hay:</i>			
Water . . . . .	60.72	30.40	10.12
Nitrogen . . . . .	3.26 - 5.78	3.85	4.66
Fat . . . . .	0.66 - 1.01	1.91	1.41
Nitrogen-free extract . . . . .	26.71 - 33.82	27.09	40.42
Fibre . . . . .	21.33 - 30.92	28.49	—
Ash . . . . .	9.52	7.86	7.71
	Grass	Hay	Hay made after flowering
<i>Percentage composition of ash:</i>			
Silicic acid . . . . .	39.34 - 60.70 %	62.56 %	60.52 %
Sand . . . . .	19.20 - 39.15	3.39	
Potassium ox.de . . . . .	7.81 - 11.02	17.83	11.97
Calcium oxide . . . . .	1.94 - 3.08	4.65	7.55
Phosphoric acid . . . . .	0.56 - 0.93	1.89	7.59
	Grass	Hay of plants in flower	Hay made after flowering
<i>Digestible nutrients (in per cent of the dry matter):</i>			
Nitrogen . . . . .	2.23 - 7.08 %	5.00 %	3.62 %
Fat . . . . .	0.69 - 1.75	0.81	1.02
Nitrogen-free extract . . . . .	27.78 - 34.90	39.95	35.52
Fibre . . . . .	24.12 - 29.07	26.32	27.37
Food value ratio . . . . .	1 : 4.5 - 1 : 7.3	1 : 5.1	1 : 6.6 - 1 : 10.5



central America and the Antilles. It is not advisable to grow it in southern Brazil, although it would do well there for pasture if mown or grazed while still tender, that is to say, from the beginning of flowering, or soon after. As the plant is very juicy, it lives for many months, thus preventing the burning of pasture-land, carried out in Brazil to renew the grass, from having the desired effect — the total destruction of the plant. The result is that the woody stems become pointed and wound the muzzles of the animals when they graze the first growth the following year. To avoid this the ground should be regularly mown or ploughed and re-sown.

The best method of utilising this plant is to make hay of it, cutting it when it has reached a height of about 2 to 3 feet. In heavy soil an average of 3 or 4 cuts a year may be made (in some soils as many as 6), in sandy soils 2 or 3. Good, fresh soils yield 120 tons of grass per acre, which gives 44 tons of hay; poor, sandy soils yield 38 tons of grass and 14 tons of hay per acre.

Analyses made at the "Istituto Agronomico" of Campinas gave the results shown in the appended table.

The hay, which is especially rich in potash (2.1 %) and lime (0.545 %), but relatively poor in phosphoric acid (an average of 0.021 %), is not favourable to milk production, but is excellent for fattening and as a maintenance ration.

This plant is known in Brazil under the various names of "Capim jaraguá", "Capim provisorio", "Capim vermelho" (at Goyaz), "Cantingueiro roxo", "Sapé gigante" (at Matto Grosso). In Colombia and at Porto Rico it is called "Yaguará"; in the Dominican Republic it is known as "Zacaté de jaraguá".

1155 — **The Cultivation of Flax in the French Colonies of North Africa.** — DYBOWSKI, J. in *Comptes Rendus des Séances de l'Académie d'Agriculture de France*, Vol. 3, No. 31, pp. 890-902. Paris, October 17, 1917.

FIBRE CROPS

In view of the rapid decline in the cultivation of flax in France, and the ever increasing need for flax fibre (a need accentuated today by military requirements), the author (professor of the National High School of Colonial Agriculture) shows the advantages of developing the cultivation of these plants in the French possessions of North Africa.

The cultural experiments in Tunis and Morocco are encouraging and may give interesting results. Up to the present this plant has been cultivated in Tunis exclusively for its seed, and the quantities obtained were 634.65 tons in 1911, 1739.70 tons in 1913, and 1268.10 in 1915. The amount of fibre obtained is still more interesting; in Tunis the yield is from 5.57 to 8.76 cwt of seed per acre, and three times that amount of straw. This straw is of inferior quality because sown too thinly (53 lbs. per acre); as a result the flax becomes branchy. About 178 lbs. per acre should be sown.

The objection raised is the lack of water for retting on the spot, but this objection falls through if PEUFAILLIT'S method (1) is used, as this does not require more than 141 to 176 cubic feet of water per ton of straw.

(1) See *B.* 1915, No. 429.

(Ed.)

## SUGAR CROPS

1156 - **The Sugar Beet in the La Plata District (Argentine and Uruguay).** — PING, N. J., in *Anales de la Sociedad rural Argentina*, Year LII, Vol. 47, No. 6, pp. 460-462. Buenos-Aires, August, 1917.

The cultivation of the sugar beet has developed in the Argentine as a result of the law of April 1906, which awarded money prizes, from that year up to 1910.

A sugar factory using beets was established at Sierra, department of Maldonado; and both the results of cultivation and the products obtained were completely satisfactory. In 1910, the production varied between 10 <sup>1</sup>/<sub>2</sub> and 11 metric tons of roots per acre; one grower obtained an exceptional yield of 30 tons per acre. The roots contained an average of 16 % of sugar, but the factory only extracted an average of 10.17 %, owing to the use of inefficient machinery.

In Uruguay, the Agricultural Laboratory of Sayago carried out experiments in sugar beet growing during a series of years in which the climatic conditions were very variable; these experiments always gave good yields per unit. The varieties grown at Sierra were; — "Dieppe (French); "Wohanka" (Austrian) and "Kleinwanzleben" (German), as well as many other varieties received from the United States Department of Agriculture: Schreiber special, Brenstedt, Henry Mette, Kleinwanzleben, Dieppe, Braune. The soil of the experimental plot was rather compact; it was not manured and was worked as little as possible. The results obtained in 1916 are given in the appended table. The commercial yield is calculated on the basis of a 13 % extraction. The last column gives the sugar content of the stock plants which are being selected at Sayago; some have as much as 19 % of sugar. As stock plants were chosen those whose roots contained more than 15 % of sugar.

*Production of sugar beets and average sugar content of the stock-plants selected. Experiments carried out at the Agricultural Laboratory of Sayago, Uruguay.*

Variety	Roots chosen cwt. per acre	Sugar produced cwt. per acre	Commercial yield of sugar cwt. per acre	Average sugar content of roots selected per cent.
Dieppe . . . . .	241.84	44.01	31.43	17.56
Wohanka . . . . .	252.00	43.34	33.75	14.69
Schreiber special . . . . .	267.43	45.57	34.90	16.77
Brenstedt, . . . . .	268.96	49.75	35.91	16.37
Henry Mette . . . . .	135.94	21.90	17.68	15.92
Kleinwanzleben (U. S. A.) . . . . .	282.84	45.25	36.76	15.93
Dieppe (U. S. A.) . . . . .	235.87	39.39	30.66	14.99
Braune . . . . .	216.77	34.20	28.17	15.15

1157 - **The Irrigation of Sugar Beets.** — HARRIS, F. S., in *Utah Agricultural Experiment Station, Bulletin No. 156*, pp. 24 + 14 figs. Logan, Utah, June, 1917.

In the United States the beet sugar industry has proved to be most successful and has found its greatest development under irrigation; in fact,

most of the sugar beets of the country are now produced with the aid of irrigation water. The expense of raising an acre of beets is, however, so great that every condition should be as favourable as possible in order to prevent losses. Unless the soil and moisture conditions are favourable it is impossible to get a crop of sugar beets sufficiently large to pay the cost of production. The cost of raising an acre of grain is relatively low, and if the crop is poor the loss is slight; with beets the farmer cannot afford to have a failure. These conditions make it especially desirable to understand the water requirements of the sugar beet plant.

The writer reviews the literature on the irrigation of beets with reference to twenty works by various authors.

The experimental work was conducted on a well-drained uniform clay loam which was manured every year and was autumn-ploughed except one year when storms made it necessary to wait till spring. The land was planted alternately to beets and potatoes. The soil will hold a maximum of about 22 per cent. of moisture under field conditions. The plats were 30 by 58.08 feet, or  $\frac{1}{25}$  of an acre each exclusive of a 7-foot space between the plants. The water was taken to the land in wooden flumes, where it was given to the beets by the flooding method. All the water was retained on the plats by banks around the edges. To a number of plats water was added each week during the growing season, but the time of applying water to most of the plats depended on the stage of development of the plants. The sugar beet plant was divided into four stages as follows: 1) just before thinning time; 2) four weeks after thinning; 3) when the beets averaged two inches in diameter; 4) when the beets were nearly, but not quite, ripe. A five-inch irrigation was used as a standard at these stages. An application of this amount was given at each stage, at each two stages, at each three stages, and at all the four stages, thus giving quite a number of different combinations. It is possible, therefore, from the results obtained, to determine which stages are best when either one, two or three irrigations are used. In the weekly irrigations one plat received one inch, another 2.5 inches, another 5 inches, and another 7.5 inches of water each week during the regular irrigation season. The experiment was begun in 1912 and carried through 1913, 1914, 1915, and 1916, giving five years' results. Conditions during these years were made as uniform as possible in every respect. The record of precipitation during the first four years averaged nearly 18 inches a year.

When the beets were watered each week during the growing season, one inch of water weekly gave a higher yield than did more than this quantity; but when one irrigation was given it was most effective when applied at the time the beets averaged about two inches in diameter.

Irrigating the land after the seed was planted and before the plants were up reduced the yield below that where no irrigation water was applied. The least desirable time to apply water after the plants had begun to grow was just before the beets were ripe. When the water was applied at the proper time, two or three irrigations of five inches each gave practically as good results as where more water was used.



Proportionately more tops were produced by the high and the later irrigations than by the opposite conditions. The percentage sugar and the purity were higher in the irrigated than in the non-irrigated beets, except where the irrigation water was added very late. The highest percentage of sugar resulted from irrigation water applied when the beets were about two inches in diameter.

Contrary to popular opinion, the length of beets was not increased by delaying the time of applying the first irrigation. The percentage of forked beets bore no consistent relationship to the amount of irrigation water applied. Irrigation water affected the average size of beets in practically the same manner that it affected the total yield.

To sum up, sugar beets do not require large quantities of irrigation water if it is properly applied, but they are sensitive as to the time it is given.

1158 — **Sugar-Beet from Locally-Produced Seed, in France.** — See No. 1144 of this Review.

1159 — ***Stevia Rebaudiana* Bert., a Sacchariferous Plant of Paraguay.** — JIMENEZ, JUAN, in *Revista de la Escuela de Comercio*, Year 3, Nos. 32 to 37, pp. 633-636. Assomption, January-July, 1917.

This plant was described in 1899 by Dr. MOISÉS S. BERTONI under the name of *Eupatorium Rebaudianum* Bert. n. sp. (*Revista de Agronomía, Escuela Nacional de Agricultura de Trinidad*, Vol. II, No. 1, p. 35); later he referred it to another genus, under the name of *Stevia Rebaudiana* Bert. (1) (*Anales científicos paraguayos*, No. 5, December, 1905). In Paraguay it is commonly known as "kaá-héé" or "yerba dulce", a name due to the extraordinary sweetening capacity of its leaves and branches. It grows wild, but in small quantities only, in the districts near the Amambay sierra, as far as the river Monday. It has been frequently analysed. DIETERICH (*Pharm. Centralblatt*, 1909. Vol. 50, p. 435) found in it two glucosides, which he called "Rebaudine" and "Eupatorine", and which had a sweetening capacity from 150 to 180 times greater than that of saccharose (2).

(1) Species admitted by the Index Kewensis — *S. Rebaudiana* Hemst., in HOOK *Iconographia Plantarum*, 2816 (1906) Parag. — *Index Kewensis Plantarum Phanerogamarum, Supplementum quartum*, p. 227, Oxonii, 1913.

(2) *C. Rebaudianum* Bert. Sacchariferous plant of Paraguay ("Kaá-Hê-É"), South America. All its parts have a marked sweet taste. Its leaves contain: 20-26 % of tannin; a sweet, glucosidic, crystallisable, red substance, probably  $C_{42}H_{72}O_{21}$ , not identical with glycerhizine which may be broken up into glucose and a substance  $C_{30}H_{40}O_5$ , with an apparently acid character; a second sweet substance, "Rebaudine" (perhaps a sodium or potassium compound of the preceding sweet substance, called "Eupatorine") containing 10-11 % of ash; these two substances have a sweetening capacity 150-180 times as great as that of sugar; a wax which melts at 57.5°; a fatty sodium substance melting at 56°; a resin, melting at 63-65°; a bitter, amorphous, hygroscopic substance melting at 50°. The sweet crude substance extracted from the plant contains all these substances (C. WEHMER, *Die Pflanzenstoffe, botanisch-systematisch bearbeitet, Phanerogamer*, p. 762. Jena, Fisher, 1911). (Ed.).

Rather than being used in competition with sugar, cane and beet, this plant may be used commercially for the preparation of medical infusions; mixed with tea, maté, and similar leaves it would give a sweetened drink and would serve as a harmless substitute for saccharine in preparations for diabetics, etc. The first necessity, however, is to cultivate the plant, and here a difficulty arises. The author's experiments have shown that it does not grow easily from cuttings, and that, as a rule, it is not reproduced from seed. In the wild state, however, there are many varieties, some of which are reproduced from seed; it would, therefore, be possible to select a fertile variety. The author has studied this subject and found an easy and sure method of reproduction. He has a plantation at "Quinta", La Esperanza, Puerto Bertoní, Paraguay.

1160 = **The Fermentation of Philippine Cacao.** — BRILL, HARVEY, C., in *The Philippine Journal of Science*, Vol. XII, Section A., No. 1, pp. 1-15. Manila, January, 1917.

The results of a census made by the Philippine Bureau of Agriculture have shown that, while only a few of the provinces raise more cacao than is enough for local consumption, there are cacao trees in nearly all of them. The conclusion is reached that the Philippine Islands can grow cacao in large quantities and become important as a cacao-producing country, all the more so, since the general consumption of this article exceeds its production. The average increase in per cent. consumption for the 5 years 1908-1912, based on the 1908 consumption, is 24.9 while the increase of production was only 11.6 per cent.

In the Philippines, the methods of preparing cacao are very crude, and no conscious effort is made to ferment the beans. The latter are dried in the sun, without any preliminary treatment, for 3 to 6 days. They are only rubbed between the hands with ashes, or rice husks, to remove the pulp previous to being placed in the sun, or else mixed with rice hulls and trodden under foot. Then they are washed to remove the pulp and finally exposed to the sun. The writer has long urged the necessity of fermenting cacao, and his opinion is endorsed by most, if not all, experts.

The provinces of Pampanga and Hilo are the chief centres of cacao production in the Philippines. Two varieties are grown: "criollo", the best, and "forastero" of very fair quality. Sixty samples of each of these varieties were examined by the Bureau of Science; the data obtained are set forth in the following table.

*Average weight of fruits and seeds of Philippine cacao.*

Types	Weight of fruits			Weight of seeds			Weight of seeds in % of weight of fruits		
	maximum	minimum	average	maximum	minimum	average	maximum	minimum	average
Forastero . .	481 g	136 g	281 g	116 g	48 g	69 g	38.1 %	14.14 %	24.6 %
Criollo . . .	531	190	355	168	65	99	38.2	17.7	27.9

STIMULANT,  
AROMATIC,  
NARCOTIC,  
AND  
MEDICINAL  
PLANTS



The writer carried out some fermentation experiments with these two varieties of cacao, and compared the analytic data obtained for them and those obtained from a number of foreign cacaos. He concluded that the Philippines can grow a good quality of cacao in large quantities, and that the time seems opportune for such an innovation.

A study of "criollo" and "forastero" cacao fermented during varying lengths of time, and the study of the respective influences of enzymes and yeasts, have led the writer to the belief that the fermentation is the joint result of the reaction of yeasts and of enzymes.

1161 - **The Cultivation of the Sweet Cinnamon Tree (*Cinnamomum Burmanni* Blume) in Sumatra.** — WYERS, E. W., in *Teysmannia*, Year 28, Pt. 4, pp. 163-170. Batavia, 1917.

*Cinnamomum Burmanni* is grown in Sumatra by the natives and in certain plantations belonging to Europeans on the western coast of the island.

The tree grows in all soils, but does best in those which are deep, permeable and rich in humus, and at heights varying between 2000 and 3000 feet. It is usually grown from seed in nurseries. At the end of 6 months the trees may be transplanted about 13 × 13 feet apart. Occasionally the natives use adventitious buds or young plants which have appeared accidentally in the plantations, but nursery seedlings are to be preferred. As the seeds lose their germinating capacity in about two weeks, they must be sown immediately after harvest. The plantation must be hoed repeatedly to prevent the growth of weeds. After 4 years, one hoeing is sufficient. After 10 years the harvest may be gathered. The trees then have an average circumference of 3 ¼ feet; their regular growth is largely dependent on the situation and the composition of the soil, but it may be much injured by careless cultivation.

For the harvest, the superficial layer of the bark is removed by scraping to a height of 6 ½ feet; the bark is then cut in strips about 3 ¼ feet long and ¼ foot wide (at the base). When all the bark of this surface has been removed the tree is felled and the bark removed from the rest of the trunk in the same way. The branches and twigs give a bark of 2nd. or 3rd. quality.

After cutting, the bark is dried; at the end of three days that which has dried sufficiently has rolled into the tubes well known on the market.

"Djamoer oepas" (*Corticum javanicum*) is the most important disease attacking cinnamon. Insects sometimes eat the leaves. A parasitic phanerogamous plant of the genus *Loranthus* is sometimes found on the twigs.

The net profit of a cinnamon tree plantation at the end of 10 years is estimated at £ 15 per acre. The natives frequently mix the bark of this tree with other similar barks, thus greatly decreasing the value of the product.

The cinnamon is re-sorted by the merchants, who divide it into four qualities, the value of which, on the local market of Padang, varies between £ 3. 3. 6 and £ 4. 12. 9 per *picol* (1 35.34 lbs.). The bark is shipped in bales of from 66 to 88 lbs.

1162 - **The Improvement of Hops by Crossing and Selection, in England.** — See N.O 1142 of this Review.



1163 — Experiments in the Cultivation of Medicinal Plants at the Agricultural Station of Bezentchuk, Russia, in 1916. — КОУЛЬЧИТЗКУ, И. (Кульчицкий И.) in *The Agricultural Gazette* (Земледельческая Газета), No. 3, pp. 71-73; No. 4, pp. 91-96; No. 5, pp. 119-121. Petrograd, 1917.

The syllabus of the Bezentchuk Agricultural Station has, since the spring of 1916, included experiments on the cultivation of medicinal plants. They were undertaken to study: 1) the local wild medicinal flora; 2) the possibility of cultivating the wild species; 3) the modifications caused in them by cultivation; 4) the introduction of species which do not exist in the district.

In a radius of about 40 miles the following species were found:

*Adonis vernalis* — *Anemone Pulsatilla* — *Melilotus officinalis* — *M. albus* — *Tanacetum vulgare* — *Chelidonium majus* — *Cichorium Intybus* — *Solanum Dulcamara* — *Mentha arvensis* — *Origanum vulgare* — *Thymus Marshallianus* — *Fumaria officinalis* — *Malva borealis* — *Hypericum perforatum* — *Rhamnus cathartica* — *Carum Carvi* — *Tussilago Farfara* — *Achillea Millefolium* — *Artemisia Absinthium*, *A. procera*, *A. vulgaris*, *A. scoparia*, *A. incana* — *Taraxacum officinale* — *Hyoscyamus niger* — *Datura sanguinea* (?) — *Capsella Bursa-pastoris*.

This list is not complete because seeds of other wild species which will be sown another year were also gathered.

In view of the large number of species found, the plots devoted to each were about 1 square yard in size; perennial species alone took up 59 square yards. Phenological observations were carried out during the growth of the plant; all the different phases of development, from germination to maturity, were noted: date of sowing; date of germination; appearance of the first leaves; appearance of the floral buds; flowering; formation of the fruit; maturation.

When picked the plants were dried in order to determine the percentage of dry matter. When there was a sufficient quantity of material, the amount of the principal medicinal substance yielded by a given plant was also determined. Below are the results of the determinations of essential oils, obtained by distillation with steam, in percentage of the dry matter.

#### Essential oil content of various species.

<i>Artemisia Absinthium</i> , during flowering . . . . .	0.5 %
» <i>incana</i> . . . . .	0.4
» <i>procera</i> . . . . .	0.7
» <i>maritima</i> . . . . .	0.3
» <i>scoparia</i> . . . . .	0.1
» <i>Dracunculus</i> . . . . .	0.3
» <i>vulgaris</i> . . . . .	0.2
» <i>pauciflora</i> . . . . .	0.2
<i>Hyssopus officinalis</i> . . . . .	0.7
<i>Thymus Marshallianus</i> . . . . .	1.12
<i>Thymus Serpyllum</i> , before flowering . . . . .	0.2
<i>Origanum vulgare</i> , during flowering . . . . .	0.6
<i>Foeniculum officinale</i> , after flowering . . . . .	1.0
<i>Mentha piperita</i> (leaves), before flowering . . . . .	1.2
<i>Mentha piperita</i> (peduncle), before flowering . . . . .	0.1
<i>Cannabis sativa</i> var. <i>indica</i> , during flowering . . . . .	0.4
<i>Matricaria Chamomilla</i> , during flowering . . . . .	0.32
<i>Coriandrum sativum</i> , unripe seeds . . . . .	0.4

Certain data were also obtained on the yield in seed of certain species per square metre (1.19 sq. yards). Thus *Calendula officinalis* gave 80 grms. *Cnicus benedictus*, 54 grms., *Coriandrum sativum*, 56 grms., *Nigella sativa*, 23 gms. and *Datura Stramonium*, 383 grms.

1164 — **Official Plants of South Australia and Their Uses.** — OSBORN, T. G. B., in *The Journal of the Department of Agriculture of South Australia*, Vol. XX, No. 12, pp. 980-981, Adelaide, July, 1917.

The flora of South Australia (and indeed of the whole of Australia) contains very few official plants. The nineteenth edition of Squire's Companion to the Pharmacopoeia (1916) gives the following for Australia: *Acacia decurrens* (bark, for tannin); *Alstonia constricta* (bark, aqueous extract for bitter principle); *Eucalyptus globulus*, *E. amygdalina*, *E. cneorfolia*, etc. (leaves, oil); *Mallotus philippinensis* (gives the drug "kamala"). Of these plants only the *Eucalyptus*, and possibly *Acacia decurrens*, are natives of South Australia.

Other indigenous drug plants are given by MAIDEN in his *Useful Native Plants of Australia*; few in the list belong to South Australia. The following are, however, natives of that country:

*Adiantum aethiopicum* (maidenhair fern). — Slightly astringent and aromatic.

*Codonocarpus cottonifolius* (quinine tree, medicine tree, horse-radish tree). — Bitter principle, but quite different from quinine.

*Cymbonotus Lawsonianus*. — Extracts of leaves with lard, used as a salve.

*Duboisia Hopwoodii* ("pituri"). — Used for chewing; has an intoxicating effect.

*Epilobium tetragonum* (native willow herb). — Diuretic.

*Erythraea australis* (native pink centaury). — Infusion used as a tonic.

*Hardenbergia* (*Kennedia*) *monophylla* (native lilac). — Used as sarsaparilla. MAIDEN says the virtues attributed to it are imaginary.

*Hydrocotyle asiatica*. — Used in India for skin diseases.

*Justicia procumbens*. — Used in India for ophthalmia.

*Melaleuca uncinata* (tea tree). — Leaves chewed for catarrh.

*Mentha gracilis* (native pennyroyal) and *M. satureioides*. — Regulating menses.

*Mesembryanthemum aequilaterale* (pig face). — Astringent properties.

*Myriogyne minuta* (syns. *Centipedia orbicularis* and *Cunninghami*). — Ophthalmic.

*Portulaca oleracea*. — Antiscorbutic.

*Pteridium aquilinum* (bracken). — Vermifuge.

*Sarcostemma australe*. — Milky juice used on wounds.

*Sebaea ovata*. — See *Erythraea* above, to which it is related.

*Typha angustifolia* (bulrush). — Rootstock used in Eastern Asia in dysentery, gonorrhoea and measles.

The following plants which are naturalised weeds in South Australia appear in the British Pharmacopoeia:

*Anthemis nobilis* (common camomile). — Flower heads.

*Conium maculatum* (hemlock). — Full-grown, unripe fruits.

*Datura Stramonium* (thorn apple). — Dried leaves and ripe seeds.

*Mentha piperita* (peppermint). — Oil distilled from fresh flowering plants.

*Ricinus communis*, *Rosmarinus officinalis*, *Taraxacum officinalis*

1165 — **The Genus *Strychnos* in India and the Far East.** — HILL, A. W., in *Royal Botanic Gardens Kew, Bulletin of Miscellaneous Information*, Nos. 4 and 5, pp. 121-210, figs. 20. London, 1917.

Owing to the difficulty of arriving at a satisfactory determination of some specimens of *Strychnos*, sent to Kew from the Philippine Islands and from Amboina, it seemed advisable to re-examine the plants from Malaya generally, and this led finally to a general revision of the genus in India and throughout the East. As a result twenty-two new species and some new varieties have been described. Two species usually regarded as synonyms have been restored and one species has been excluded.

The present account is far from exhausting our knowledge of the genus in the East, as there is good evidence of several species in Siam, Cochinchina, Borneo, the Philippine Islands, etc., which are represented in herbaria by leaf specimens only, and have not yet been described. Ninety-three species of *Strychnos* have now been described from India and the East by various authors, but as one of these is excluded in the present account the actual number of well-authenticated species in this region is really ninety-two. The Author's classification is as follows:

**PREVITUBAE:** *S. paniculata* — *aenea* — *Vanprukii* — *tetragona* — *Maingayi* — *ovata* — *villosa* — *lanceolaris* — *hirsutiflora* — *bicirrhosa* — *vitiensis* — *hypogyna* — *andamanensis* — *panayensis*.

**LAJANIGERAE:** *S. flavescens* — *cinnamophylla* — *septemnervis* — *Forbesii* — *laurina* — *similis* — *barbata* — *potatorum* — *flavescens* — *angustiflora* — *coriacea* — *polytrichantha* — *dubia* — *oleifolia* — *micrantha* — *colubrina* — *lenticellata* — *Merrillii* — *pycnoneura* — *myriantha* — *multiflora* — *Curtisii* — *lanata*.

**PENICILLATAE:** *S. Benthani* — *quintuplinervis* — *pubescens* — *Ridleyi* — *Robinsonii* — *Scortechinii* — *axillaris* — *Schmidtii* — *armata* — *plumosa* — *psilosperma* — *arborea* — *trichocalyx* — *Dalzellii* — *malaccensis* — *penicillata* — *Wenzelii* — *Ledermannii* — *Horsfieldiana* — *palembanica* — *luzonensis* — *impressinervis* — *mucronata* — *oophylla* — *melanocarpa* — *polytoma*.

**TUBIFLORAE:** *S. angustiflora* — *Nux-vomica* — *Nux-blanda* — *lucida* — *cinnamomifolia* et var. *Wightii* — *tubiflora* — *rupicola* — *Pierriana* — *Wallichiana* — *Spireana* — *cuspidata* — *Balansae* — *Ignatii* — *Tientii* — *ovalifolia*.

Species non satis notae: *S. rufo* — *narcondamensis* — *Gauthieriana* — *quadrangularis* — *lesseroidea* — *monosperma* — *myrioneura* — *Thorelii* — *polyantha* — *donniansis* — *usitata* — *dinkensis* — *leuconeura* — *Kerstingii* — *Bancroftiana*.

Economically, the two most important species dealt with are *S. Nux-vomica* and *S. Ignatii*, on account of the strychnine and brucine contained in the seed. The seeds of *S. lucida*, *S. cinnamomifolia*, and possibly other species, also contain a fair percentage of alkaloids, but there is no evidence that they have been commercially exploited. The bark of *S. Gauthieriana*, Pierre, known under the native name "Hoang Nan", is said to be very efficacious in cases of leprosy and also to be employed by the



natives in Tonkin as an antidote for hydrophobia. *S. colubrina* from S. India has been in repute from early times, under the name "lignum colubrinum", as a specific for snake bite, and it is also used as a tonic in dyspepsia and malaria by the Hindus, no doubt on account of the strychnine contained in the wood of the root. This alkaloid also occurs in the wood and bark of *S. Nux-vomica*, and possibly of other S. Indian species and it is probable that the products of more than one species of *Strychnos* pass under the name "lignum colubrinum". RUMPHIUS'S *Arbor ligni colubri* is *S. ligustrina*, a species quite distinct from the Indian plant. The bark of the root of *S. Tienté* also contains strychnine, and yields the poison known in Java as "Radja" or "Tienté". The bark of the roots of *S. quadrangularis*, Hill, from Perak, is used as an arrow poison by the Sakais, and strychnine no doubt also occurs in the root bark of *S. ovalifolia*.

The pulp of the fruits of *S. Nux-vomica* is readily eaten by birds and also by monkeys in India though it contains some strychnine, and the Shans are said by BURKILL to eat the pulp of the fruit of *S. Nux-blanda*, Hill, which is probably — like the seeds — almost free from alkaloid.

The seeds of *S. potatorum* are well known for their property of clearing muddy water, and the fruit pulp is edible.

At least six of the species under consideration are trees, namely, *S. Nux-vomica*, *S. Nux-blanda*, *S. potatorum*, *S. arborea*, *S. ligustrina* and *S. polyantha*. There is also probably, in addition to these, another tree in Queensland of which the wood only is known. The trees yield good timber which is heavy and close-grained, and characteristically marked with white spots in transverse section (or white streaks in longitudinal section) due to patches of interxylary phloem.

Among the results of the present investigation perhaps the most interesting is the recognition of the Burmese tree — previously referred to *S. Nux-vomica* — as a distinct and very definite species, the seeds of which do not contain any appreciable quantity of alkaloid. *S. Nux-vomica* occurs in Ceylon, India extending to Bengal, and is also found in French Indo-China, while *S. Nux-blanda*, the new species, ranges from Manipur, all through Burma to Siam and Cochin-China. Like *S. Nux-vomica*, it is a native of the drier regions and deciduous forests.

1166 — **The Use and Chemical Composition of the Seeds of *Hydnocarpus venenata*, *H. alcala*, and *Pangium edule*.** — BRILL, C. HARVEY, in the *Philippine Journal of Science*, Vol. XI, Sect. A, No. 2, pp. 75-80; Vol. XII, Sect. A, No. 1, pp. 37-46. Manila, March, 1916, January, 1917.

Owing to the inaccessibility of the regions producing the chaulmoogra oil of commerce, obscurity envelops the source of this product which is used in the treatment of leprosy (1). For a long time it was supposed that this

(1) Chaulmoogra oil is one of the remedies most in vogue for leprosy, and one of the very few which, if they do not cure the disease, have arrested its progress for a long time, or even entirely. These results are, however, rare, for they can only be obtained by an intensive use of the remedy and in this a great difficulty is encountered. The patient cannot bear strong

oil came from the seeds of *Gynocardia odorata*, but true chaulmoogra oil is obtained from the seeds of *Taraktogenos kurzii*, although the oil from the seeds of *Hydnocarpus Wightiana*, *H. anthelminticus* and *H. venenata* is probably often substituted for it. Oil from these last-named trees is known as "kavatel" in Malabar, and is so similar in its properties to chaulmoogra oil, that a distinction by chemical means is hardly possible. It is for this reason, that the writer has undertaken a series of investigations of the oils of other *Bixineae* similar to the genus *Taraktogenos*.

*Hydnocarpus venenata*. — The nuts, heated at 100° C. to destroy any enzymes present, and then dried, yielded 45.57 % of dry kernels. The latter gave by expression a yield of 51.18 % of oil. Its properties, compared with those of similar oils, are given in Table I. The presence of a cyanogenetic glucoside was detected in the press cake. Table I shows the chemical constants of oils from *Taraktogenos kurzii*, *Hydnocarpus Wightiana*, *H. anthelminticus* and *H. venenata* to be similar, therefore their physiological properties should be identical; but the properties of *Gynocardia* oil may be different or not, according to whether the physiological activity is caused by the unsaturated acids present in the chaulmoogra and *Hydnocarpus* oils, or by the glucoside present in all these seeds.

TABLE I. — Constants of the oils from the seeds of *Taraktogenos kurzii*, *Hydnocarpus Wightiana*, *H. anthelminticus*, *H. venenata* and *Gynocardia odorata*.

Constants	<i>Taraktogenos</i> <i>Kurzii</i> ("chaulmoogra")	<i>Hydnocarpus</i> <i>Wightiana</i>	<i>Hydnocarpus</i> <i>anthelminticus</i>	<i>Hydnocarpus</i> <i>venenata</i>	<i>Gynocardia</i> <i>odorata</i>
Melting point. . . . .	22° C	22° C	23° C	20° C	Liquid at 20°
Specific gravity. . . . .	0.951 at 25° C	0.958 at 25°	0.953 at 25°	0.948 at 30°	0.925 at 25°
Specific rotation. . . . .	+ 52.0°	+ 57.7°	+ 25.5°	+ 52.03°	Inactive
Iodine value. . . . .	103.2	101.3	86.4	99.1	152.8
Acid value. . . . .	23.9	3.8	7.5	4.4	4.9
Saponification value. . . .	213	207	222	200.3	197
Index of refraction. . . .	1.476	—	1.473	1.477	—
Cyanogenetic glucoside. . .	present	present	present	present	present
Chaulmoogric acid. . . . .	do	do	do	do	absent
Hydnocarpic acid. . . . .	do	do	do	do	do

*Hydnocarpus alcalae*. — The fruits (nuts) examined came from Luzon

doses of the remedy either administered through the mouth, or in the form of injections (further, the latter are very dangerous, as they may produce death from fatty embolism). DR. I. STEVENEL, of the Laboratory of the Institute of Hygiene and Microbiology of Fort de France (Martinique), has succeeded in preparing, with the collaboration of Dr. Noc, an emulsion of chaulmoogra oil in which the fat globules are smaller than the red blood corpuscles. Intravenous injections of this emulsion can be borne by patients. With regard to the preparation of this remedy, and the satisfactory results obtained with it, see *Bulletin de la Société de Pathologie Exotique*, Vol. X, No. 8. pp. 684-687. Paris, October 10, 1917. (Ed.)

(Philippines), where they are called "dudu dudu". The oil and seeds are used there for dressing wounds.

Table II gives the chief results of the analysis of the fruits and their oil.

TABLE II. — *Characters of the Fruits and Oil of Hydnocarpus alcalae.*

A. — *Fruits.*

Average weight of fruits (diameter $20 \times 15$ cm.). . . . .	420 grm.
Shells . . . . .	56.98 %
Seeds (numerous; diameters $4 \times 2.5$ cm.). . . . .	40.32 %
Water in seeds . . . . .	60.50 %
Oil in dry seeds . . . . .	65.50 %

B. — *Oil.*

	Oil	Free acids of oil
Melting point. . . . .	32° C.	59° C.
Specific gravity at 30° C. . . . .	0.9502	0.9342
Specific rotation in chloroform . . . . .	+ 49.66°	+ 53.65°
Iodine value (Hanus) . . . . .	93.10	98.6
Acid value (NaOH N/10) . . . . .	3.90	37.4
Saponification value . . . . .	188.90	193.0
Index of refraction . . . . .	1.4770	—
Reichert Meissl number . . . . .	4.43	—

More than 40 % of the free acids consist of a compound possessing the same properties as the substance called by POWER chaulmoogric acid. It has not been possible to isolate hydnocarpic acid, therefore it is certain that little or none is present in *H. alcalae*. Palmitic acid has been isolated, but only traces of oleic acid found.

*Pangium edule*. — DE JONG has isolated from the leaves of *P. edule* a cyanogenetic glucoside, similar to that isolated by POWER and others from *Gynocardia odorata* and called "gynocardine". The writer isolated it from the seeds of *P. edule* and obtained it in the form of needle-shaped crystals, of a golden yellow colour, melting at 160° C. He obtained 0.2-0.3 per cent. of these crystals from the dry seeds of green fruits. Gynocardine differs from other glucosides in its great stability in the presence of acid hydrolysing agents. The writer has isolated from the leaves of *P. edule* an enzyme which he called "gynocardase" and which hydrolyses both gynocardine and amygdaline.

The oil obtained from the seeds showed the characters given in Table IV. It contains palmitic and oleic acid, as well as small quantities of an optically active acid, which may be hydnocarpic or chaulmoogric acid, or a mixture of both. If this is the case, and if its power of curing leprosy is due to the esters of hydnocarpic and chaulmoogric acid, it should be extremely easy to administer, seeing its low melting point. It is probable, however, that its action would be slow, for these esters are only found in it



n comparatively small amounts. On the other hand, the oil of *H. alcala* would be much more difficult to administer, because it is still solid at the ordinary temperature of Manila (30° C.)

TABLE III. — *Oil content of the Seeds of Pangium edule.*

	Ripe fruits	Green fruits
Content of the seeds of air-dried fruits (nuts) . . . . .	42.67 %	36.38 %
Content of dried seeds in relation to the air-dried fruits. . . . .	20.09	16.28
Oil content in relation to the dry seeds . . . . .	21.09	24.11

TABLE IV. — *Physical and Chemical Constants of the Seeds of Pangium edule.*

Constants	Free acids obtained from the oil of ripe seeds	Oil of ripe seeds	Free acids obtained from the oil of unripe seeds	Oil from unripe seeds
Melting point. . . . .	Cloudy at 18°C.	Slightly cloudy at 2°C.	—	No change at 8°C.
Specific gravity. . . . .	0.9013	0.9049	0.8955	0.9092
Specific rotation in chloroform solution . . . . .	+ 3.49	+ 4.28	+ 4.72	+ 20.65
Iodine value (HANUS) . . . . .	113.5	113.1	103.30	109.5
Acid value (NaOH N/10). . . . .	36.7	0.52	34.2	0.90
Saponification value. . . . .	207.8	190.3	205.4	188.3
Refractive index . . . . .	1.4582	1.4665	1.4595	1.467

1167 — **Fruit Nomenclature (Fourth Conference of the Pomological Committee of Australia, 1917).** — PESCOTT, E. E., in *The Agricultural Gazette of New South Wales*, Vol. XXVIII, No. 8, pp. 578-590. Sydney, August, 1917.

FRUIT  
GROWING

The following rules were considered as urgent by the Pomological Committee of Australia at its fourth annual Conference of Sydney (1917).

- 1) That the names shall be as simple as possible.
- 2) That wherever possible one word only should be used as a name.
- 3) Duplication of names, or names possessing strong similarity, is to be avoided.
- 4) That such words as "seedling" and "hybrid" be abolished from Australian Pomology as far as possible.
- 5) That priority of name, naming, or of origin, have preference wherever possible.

In order to have a uniform method throughout the various States of taking description of fruits the following form was adopted :

## Form for Describing Apples and Pears

THE POMOLOGICAL COMMITTEE OF AUSTRALIA

APPLES and PEARS

(Specimens and Information for Pomological Records).

### SECTION I.

The accompanying specimens of . . . . . were obtained from Mr . . . . .  
 Orchard . . . . . at . . . . . Grown on . . . . . Soils . . . . .  
 Average Annual Rainfall . . . . .  
 Suggested Name . . . . .  
 Origin . . . . . Age of tree . . . . .  
 The original tree is still growing at . . . . .  
 Age of tree from which samples were taken . . . . .  
 Worked on . . . . . Stock . . . . .  
 Habit of Growth . . . . .  
 Description of Bark . . . . . Leaf . . . . .  
 Blossoming Date . . . . .  
 Cropping Characteristics . . . . .  
 Date of Ripening . . . . .  
 Keeping Qualities . . . . .  
 Subject to what diseases or pests . . . . .  
 Any other information . . . . .  
 . . . . .

Signed . . . . .

Date . . . . .

### SECTION II.

To be filled at the Head Office.

Form . . . . .  
 Size (in inches) . . . . . high . . . . . wide . . . . .  
 Colour of skin . . . . .  
 Dots, markings or russetts . . . . .  
 Eye . . . . . Basin . . . . .  
 Segments . . . . .  
 Stalk . . . . . Cavity . . . . .  
 Stamens . . . . . Tube . . . . .  
 Core . . . . . Axile . . . . . Abaxile . . . . .  
 Flesh texture . . . . . Colour . . . . .  
 Flavour and quality . . . . .  
 Used for dessert . . . . . Culinary . . . . .

1169 - **Table Grape Hybrid Bearers.** — PÉE-LABY, E., in *Revue de Viticulture*, Year 24, Vol. XLVII, No. 1217, pp. 261-263. Paris, October 25, 1917.

VINE GROWING.

In view of the ever increasing difficulties met with by vine-growers in protecting their vines, such as *Chasselas*, *Muscat* and *Mortierille*, which produce table grapes, from the attacks of cryptogamic diseases and insects, the author considers the question of hybrid bearers of table grapes. Among those recently created are some which might replace, even advantageously, the *Chasselas* and *Muscats*.

*Girerd 157* has long proved its value in this respect. It has been particularly appreciated when *Chasselas* failed, and, some years, keeps as long. When picked when well ripened it is much sweeter than *Chasselas*, and its flavour is preferred by many. When grown from seed in a suitable exposure it gives very good grey-pink grapes. Grafted on the *Rupestris* du Lot, on 1202 and 3306, it gives much larger fruit than *Chasselas*. According to its exposure, *Girerd 157* ripens simultaneously with or a little later than *Chasselas*. It is easily protected against disease by two treatments with sulphur and two or three with sulphate.

*Seibel 5279* is at least 15 days earlier than *Chasselas*, and is less fleshy and sweeter. Its cylindrical bunches, sometimes with a small side bunch, remain hanging a very long time without rotting. This hybrid, which is very resistant to disease, requires no special care or treatment.

*Seibel* No. 2653 is still more palatable. On account of the appearance of its grapes it has been called "*Flot d'or*". It produces the prettiest table grapes there are, but is subject to "millerandage", which attacks it certain years. In 1917 it gave excellent results. Although attacked by mildew it is much less subject to this disease than *Chasselas*, or even *Girerd 157*. Two treatments with sulphate are adequate protection. So far it has not been found to suffer from oïdium.

The author considers *Seibel 4752*, which give grapes used in the vats, capable of producing table grapes as well. Its medium sized, longish bunches of loose, medium sized, round, yellowish grapes, ripen at the same time as, or a little later than *Chasselas*. It is an excellent grape, very sweet; in 1917, in the oenometer, it showed 13.9° of alcohol. In years such as 1917 it requires neither sulphate nor sulphur treatment.

As hybrids capable of giving a table grape with a musk flavour are mentioned *muscat Dumoulin 299-35 de Couderc* and *1897-12 de Malègue*; they ripen about the same time as the preceding varieties.

A hybrid resistant to all diseases, which gives an excellent, very fine, very sweet, yellowish grape which can be left a long time on the plant, is 4681 de *Seibel*. This year, in the *Dujardin* oenometer the fruit of this hybrid gave 13° of alcohol. The foliage is immune to all disease.

1170 - **Hybrid Direct Bearers in the Seine-et-Marne District, France, in 1917 (1).** — SALOMON, RÉNÉ, in *Revue de Viticulture*, Year 14, Vol. XLVII, No. 1210, pp. 298-300. Paris, November 8, 1917.

The author gives the results of observations which, owing to the excep-

(1) See R. August, 1917, No. 731.

(Ed.).



tional violence of mildew in 1917, he was able to make on his direct bearers as regards their resistance to this disease.

He affirms that every direct bearer which needs treating as a *Vinifera* should be rejected, but that, nevertheless, those which give a good yield must be kept, even if this can only be done by grafting and the harvest can only be saved by two or three sulphate treatments, whereas ten will not always save the *vinifera* harvest.

The only treatment given the 60 varieties of direct bearers in the author's vineyard consisted of the first two sulphate sprayings.

Among these 60 varieties the following proved completely resistant to mildew :

**WHITE VARIETIES.** — *Oberlin* 782, requires short pruning ; rather liable to non-setting in cold springs.

*Couderc* 272-60 ; young shoots which have not been trained and which trail on the ground have proved as immune as those which do not touch the ground ; rather liable to non-setting in cold springs.

*Seibel* 845, fine clusters — *Seibel* 2719, requires strong stock.

*Hoger*, Noah variety with seed adhering to the pedicle.

**PINK VARIETIES.** — *Castel* 19 002, in cold, rainy seasons lignified badly in the climate of Paris.

**BLACK VARIETIES.** — *Baco* 24-23 No. 1.

*Castel* : 3 343, a little late for the climate of Paris ; — 2 528, 4 001, 8 930, very strong, planted in dry, warm soil, the fruit was gathered on September 1.

*Couderc* 7 120, too late for the climate of Paris ; 7 103, 7 104, require strong stock.

*Bertille-Seyve* 822, valuable in the north, although late, on account of the very late opening of its shoots.

*Hybride Fournié*, supposed by some to be subject to *oïdium*, proved absolutely immune to this disease without any treatment.

*Gaillard-Girerd* No. 2, slightly liable to non-setting in cold springs.

*Oberlin* 595, harvested on September 1.

*Seibel* : 128 ; — 131, requires strong stock ; — 2 734, fine vegetation, strong bunches ; 2 828, too liable to non-setting in cold springs ; — 2 834, very strong.

In an experimental plot with eastern exposure, cold, marly, subject to frost and, after midday, shaded by high trees, left, moreover, purposely in an untidy condition verging on neglect, were planted 200 different varieties of all ages. Of these, the following proved absolutely immune to mildew *without any treatment* :

**WHITE VARIETIES.** — *Oberlin* 782, the only one of the direct bearers mentioned above growing in this plot.

**BLACK VARIETIES.** — *Baco* 24-23, No. 1 ; *Bertille-Seyve* 822 ; *Gaillard-Girerd* No. 2 ; *Oberlin* 595 ; the only direct bearers mentioned above growing in this plot.

Then :

**WHITE VARIETIES.** — *Bertille-Seyve* 485, shoots open late.

*Seibel* : 2 661, requires very long wood, rather liable to non-setting in cold springs ; 2 875 too late for the climate of Paris ; — 4 792, irregular fertility ; — 4 576, already recommended previously ; — 4 574, 4 603, 4 681, 4 871, 5 023, yielded for the first time ; their resistance to mildew and *oïdium* was noticed.

**PINK VARIETIES.** — *Seibel* : 4 075, first harvest ; — 4 638, in late years its wood only ripens with difficulty ; complete non-setting in cold springs ; annular incisions have an effect contrary to that desired.

BLACK VARIETIES. — *Bertille Seyve*: 460, shoots open late; 872, first harvest; — 893, harvest in 1916 not very good; 1129, first harvest.

*Seibel*: 4565, wood ripens with difficulty in late years; complete non-setting in cold springs; — 4637, 4638, too late for the climate of Paris; 4696, first harvest.

1171 — The “*Madone*” Vine in the Department of Aude, France, in 1917 (1). — PÉE LABY, R., in *La Vie agricole et rurale*, Year 7, No. 46, pp. 334-336. Paris, November 17, 1917.

Wishing to know how the *Madone* variety did in 1917 the author (lecturer in the Faculty of Science of Toulouse) paid a visit on September 20 to Arzens (Aude), where this vine had been found by M. ANGLES in the midst of a plantation of 128 *Seibel*. The fruit was ripe and ready to be gathered.

On the hillsides, in the plain, grafted on to various stocks, and direct, the *Madone* always maintained its reputation, proving what might be called almost perfectly resistant to mildew and oidium, and extraordinarily fruitful, too much so to give large grapes.

The weight of the bunches varied greatly, the averages being between 65 and 170 grms; even taking the minimum average weight of 60 grms. per 80 to 100 bunches per plant, it may be seen how good the harvest was. In a vineyard planted with *Madone* 8 years old, mounted on wire, and well tended (well pruned, disbudded at the beginning), the harvest could be estimated at over 20 lbs. per plant.

Wine made from *Madone* contains 10° of alcohol, whereas that made from Aramon grown in the same soil contains 5 or 6°. It has a fine, strong colour, of a better red than that of most wines made from hybrids, which usually have a violet shade.

The growing of *Madone* is greatly extending in France on account of its qualities — great fertility, considerable and regular annual yield, resistance, so far at least, to all cryptogamic diseases without any copper or sulphur treatment.

According to M. ANGLES' investigations on the affinity of *Madone* for stock, this plant has decided preferences. Apart from its perfect affinity for *Riparia* and *Rupestis*, it may be grafted with varying proportions of success on all the others. The following stock are given in order of the strength and yield obtained with them in 1917: — *Riparia* and *Rupestis* gives perfect knitting; the former gives finer fruit with larger seed; the stock 216-2 is as good for *Madone* as *Riparia*; 41-B and 93-5 are equal, but come a good deal after the first three; 222-21 also seems satisfactory; 420-A follows, without great strength; *Solonis-Riparia* 1616, 261-49 and 62-66 do not appear to be satisfactory subjects.

1172 — The Cultivation of Grapes for Export in the District of Almería, Spain. — HARO, SALVADOR, in *Información agrícola*, Year VII, No. 157, pp. 330-333; Madrid, October 1st, 1917.

For a great number of years vines (“parras”, “parrales”) bearing grapes for export (“uva de embarque”) have formed the chief agricultural wealth of the Almería district (Andalously). In this town and in the

(1) See B. 1913, No. 683.



neighbouring villages, the houses are often covered with vines which reach up to the roof; the grapes are not picked till Easter, when a large quantity is eaten. This gave rise to the idea of exporting these grapes which keep so easily. They were originally exported in esparto baskets, for which, later, were substituted barrels containing cork shavings.

Cultivation was greatly reduced by the appearance of phylloxera, but spread again with plantations of vines grafted on to *Riparia*, *Rupestris*, *Berlandieri*, or on hybrids of *Berlandieri* with the local varieties white Barco and Castiza.

There are white and black Almería grapes; they all have large round or oval seed, according to the variety. The white grapes are most widely grown because they have a more pleasant flavour, but, since they have a thinner skin, they are less exported than the black grapes, which are earlier.

The cultivation of these grapes, which increases every year, is carried out as follows: — about 400 to 600 vines are planted on one acre at equal distances, in squares. The vine is allowed to grow, cutting all the shoots which appear, till it reaches a height of from about 8 to 10 feet. At this height above the soil, is then built a trellis of wire, crossed so as to form squares about 20 inches wide, the ends being strongly fastened to posts driven into the ground near the vine. When the plant begins to grow all the young shoots are fixed on to the metal trellis by tying them with string until the desired shape is attained, when it is no longer necessary to tie them. The shoots which grow above the trellis are cut. Besides pruning, which is carried out with great care, the ground is shallow cultivated three times, the last time being preceded by the spreading of manure. Various manures are used; the most common is composed of 132 lbs. superphosphate (18-20 %); 22 lbs. ammonium sulphate; 44 lbs. sodium nitrate; 22 lbs. iron sulphate. About 528 to 616 lbs. of this mixture are broadcast per acre. The manure is dug in in February. If it does not rain a few days after, a first irrigation is given; there are two other irrigations during the course of the year.

When the first leaves began to open treatment with sulphur and Bordeaux mixture is begun; at least three treatments with each mixture are given in the year. Up to the harvest, which usually begins at the end of July, the soil is hoed and its surface broken.

As soon as the grapes become juicy thinning of the leaves ("despampnado") is begun. This operation, carried out by women, consists of cutting away the leaves round the clusters, so that the sun may penetrate and hasten ripening. During this operation, besides the damaged leaves, the spoilt grapes are also removed, the plant is then washed with water (by means of a spray) to remove the dust and help leaf transpiration. These two operations, especially the first, are continued daily till the harvest. The harvest and packing into barrels is carried out almost exclusively by women and children. The bunches of grapes are cut with scissors, care being taken not to damage them. They are then placed in vats, capable of holding from 60 to 80 lbs., which are not entirely filled and which are transported to another place, where a larger staff sorts them for the first time; they are then resorted with greater care. The packing of the barrels with



alternate layers of grapes and corkshavings, so that the shavings come at each end of the barrel, is done by women; the barrels are closed by men.

Each barrel contains about 55 lbs. of grapes. The average harvest is  $2\frac{1}{2}$  million barrels. The price is dependent on the British market, which is the largest buyer. Glasgow is one of the chief importing ports.

The cost of packing is estimated at 5*d.* a barrel, plus the cost of the barrel and the wages of the packers: 1*s.* 3*d.* to 1*s.* 8*d.* a day. Each woman is required to fill 100 barrels a day.

Dalias grapes are most favoured and fetch from 5*s.* to 6*s.* a barrel more than those from other places. This is due to more careful cultivation.

**1173 — Reforestation on the National Forests of the United States** (1). — TILLOTSON, C. R. (Forest Examiner), in *United States Department of Agriculture, Bulletin* No. 475, *Contribution from the Forest Service, Professional Paper*, pp. 63, fig. 5 + 11 plates. Washington, May 2, 1917.

FORESTRY

The Bulletin analysed is a revised edition of a preceding one (No. 98 by W. T. Cox), but it has been brought up to date as regards the results of the reforestation work of the Forest Service in the United States and the methods at present employed.

In the United States National Forests there are about 5 600 000 acres to be reforested. The greater part of this area consists of land where former forests have been entirely destroyed by recurring fires. The complete restocking of the areas now denuded, or sparsely timbered, will increase the annual wood production at least 3 000 000 000 ft. For this reason, reforestation is an essential feature of National Forest Administration.

The bulletin analysed contains a description of the methods of collecting and preparing forest seed.

The following data, which are of considerable practical interest, are obtained from the various tables given.

	Trees per acre	Seed per acre — lbs	Net cost per pound —
Douglas fir . . . . .	10	35.00	\$ 0.66—1.36
Western yellow pine ( <i>P. ponderosa</i> Law.)	5	30.00	0.41—0.67
Lodgepole pine ( <i>P. murrayana</i> Engelm.)	40	8.00	1.70—2.00
White pine ( <i>P. strobus</i> L.). . . . .	7	7.00	2.43—2.83
Norway pine ( <i>P. resinosa</i> Ait.). . . . .	5	4.00	2.63—3.19
Engelmann Spruce ( <i>Picea engelmanni</i> Engelm.) . . . . .	12	12.00	1.00—2.41
Sugar pine ( <i>Pinus lambertiana</i> Dougl.)	8	80.60	0.50—0.65

Of a total area of 124 732 acres covered up to June 30, 1915, 84 320 acres were seeded directly and 40 412 acres were planted.

The writer describes the methods of sowing and planting adopted, gives the figures, the rules to be observed, and the relative cost per tree, region and method.

**1174 — Forest Products of Canada.** — I. BATES, J. S. (Superintendent of the Forest Product Laboratories of Canada) and LEE, H. N. (in Charge of Timber Physics), Canadian Woods for Structural Timbers, in *Department of the Interior, Canada, Forestry Branch, Bulletin* No. 59, 44 pp. + 3 fig. + 19 plates. Ottawa, 1917. — II. Forest Products of Canada, 1916, Pulpwood, *Ibid.*, *Bulletin* No. 62-<sup>b</sup>, 12 pp. + diagrams and maps. Ottawa, 1917 (1).

The Forest Products Laboratories of Canada, established at Montreal by the Department of the Interior, in co-operation with Mc. Gill University, have undertaken an investigation of the woods of the different species of trees in Canada.

I. — The first-named publication begins by stating the available and authoritative information regarding the indigenous coniferous woods of Canada, and compares them with foreign woods, especially with those imported from the United States. Some account is also given of Canada's forests and timber supply and of the present development of the timber trade in that country. The principal woods are mentioned, particularly the chief structural woods. The latter, named in order of merit and resources are: Douglas fir (*Pseudotsuga mucronata*), western hemlock (*Tsuga heterophylla* Sarg.), eastern hemlock (*Tsuga canadensis* Carr.), western yellow pine (*Pinus ponderosa* Laws), western larch (*Larix occidentalis* Nutt.), red pine (*Pinus resinosa* Ait), and eastern larch (*Larix americana* Mchx. or *Larix laricina*). The Douglas fir supplies more of the timber cut in Canada than any other single species; practically all of it comes from British Columbia, where 601 643 000 ft., board measure, were cut in 1914.

The writer also discusses the grading rules and specifications for structural timber.

II. — The second publication of the Forest Service of the same Department deals with another important branch of the Canadian forest industry, the pulp and paper industry. In 1916, 1 764 912 cords of pulp wood were used in Canada, the percent. distribution of which was as follows: for pulp made by mechanical process, 46.9 per cent.; by sulphite process, 41.3 per cent.; by soda process 0.4 per cent. As in the past, spruce heads the list of the different kinds of wood used, with 68.2 per cent. of the total, followed by balsam fir with 24.5 per cent., hemlock with 4.7 per cent.; jackpine with 2.7 per cent. and poplar with 0.3 per cent. The exportation of wood pulp and cellulose reached its maximum in 1916, when it rose to 367 840 tons, 59 per cent. being of the former, and 41 per cent. of the latter.

**1175 — Mechanical Properties of Woods Grown in the United States.** — NEWLIN, J. A. (in Charge of Timber Tests) and WILSON, T. R. C. (Engineer in Forest Products), in *United States Department of Agriculture, Bulletin* No. 556, *Contribution from the Forest Service, Professional Paper*, 47 pp., bibliographical index + III plates. Washington, September 15, 1917.

The increasing scarcity of many species of timber which had become more or less standard in various wood-using industries, is opening the field



for other species ; hence it is necessary to have definite information and data which render it possible to compare the properties of a known species with those of any other.

The publication analysed gives practical data that can serve as a basis for : 1) the comparison of the different species ; 2) the selection of species suitable for special requirements ; 3) the compilation of reliable figures for tests of the resistance of the various woods.

The data are based upon about 130 000 tests (of 126 different woods) carried out by the Forest Products Laboratory, which is maintained by the United States Forest Service with the co-operation of the University of Wisconsin. It is planned to continue the series of tests until all species of wood which are important, or which give promise of becoming so, have been included. The data are given in 2 series of tables, one for green wood and the other for air-dry wood. The scope and method of experiments are first set forth, together with a definition of the terms used.

**1176 - Yields from the Destructive Distillation of Certain Hard-Woods in the United States.** — PALMER, R. C. (Chemist in Forest Products), in *United States Department of Agriculture, Bulletin No. 508, Contribution from the Forest Service, Professional Paper*, 8 pp., 2 fig. Washington, 1917.

The results of experiments carried on at the Forests Products Laboratory, maintained at Madison, Wis., by the United States Forest Service, in co-operation with the University of Wisconsin. The object of these investigations was to determine the relative value of the various hardwoods commonly used for destructive distillation (and of the different forms of material such as bodywood, limbs and slabs) in comparison with the standard American species, beech, birch and hard maple. The bulletin analysed gives the yields for : white elm (*Ulmus americana* L.); slippery elm (*Ulmus fulva* Michx); silver maple (*Acer saccharinum* L.); green ash (*Fraxinus nigra* Marsh); blue ash (*Fraxinus pensylvanica* var. *lanceolata* Sarg.); yellow ash (*Fraxinus quadrangulata* Michx.); *Fraxinus velutina* Torr.; chestnut oak (*Quercus Prinus* L.); tanbark oak (*Pasania densiflora* Orst.); Californian black oak (*Quercus Californica* Coop.); Louisiana swamp oak (*Quercus* spp.); and *Eucalyptus* spp.

Previously, "red gum", chestnut, *Micoria* sp., *Quercus alba* L., and *Nyssa sylvatica* Marsh had been tested. Of the above-mentioned trees, *Pasania densiflora* gave the highest yield of 80 per cent. acetate of lime from the heart wood, *Eucalyptus* from the slab-wood and *Quercus Californica* from the branches.

The largest amount of 82 per cent. methyl alcohol was, on the other hand, obtained from the heartwood of the ashes, the slabs of eucalytus, and the branches of *Fraxinus pensylvanicum* var. *lanceolata*. The relative yield of these species exceeds that of beech, birch and hard maple, with which they are compared by taking the average of the latter as 100 per cent. It is, however, necessary to observe that the laboratory yields of acetate of lime are over 50 per cent. higher than those obtained in standard commercial practice, though the alcohol yields do not differ much from the commercial yields. The slabs sometimes contain more acetate and alcohol than the body



wood; this is the case with *Quercus Prinus* and Eucalyptus, and is a matter of considerable interest to the saw-mill.

## LIVE STOCK AND BREEDING.

### HYGIENE

1177 - A Disease of Cattle in the Philippine Islands Similar to *Anaplasma Marginale* Theiler. — BOYNTON, W. H., in *The Philippine Agricultural Review*, Vol. 10, No. 2, pp. 119-127, bibliography of 7 publications. Manila, 1917.

In 3 native cattle from Batan Island which were taken to the Manila Veterinary Research Laboratory in June 1915, there were observed bodies in the red blood cells similar to *Anaplasma marginale* as described by THEILER and SIEBER. One of the animals, a cow, presented also the symptoms and lesions of anaplasmosis as described by the above-mentioned writers. The heart blood of this cow was injected subcutaneously into a bull which was supposed to be susceptible to the disease, but without any demonstrable effect, either physically, or by blood examination, upon this animal during a period of 226 days.

These 3 cases are the only ones which have come to the notice of the writer during the past 20 months. This creates a doubt as to whether anaplasmosis really exists in the Philippine Islands, or whether these animals suffered from some other ailment which brought about the formation of these anaplasma-like bodies in the red blood cells.

On studying the literature dealing with the subject, the writer found that mention is made of the fact that bodies similar to *Anaplasma* may be produced artificially. He therefore concludes that, "from the results obtained by various investigators, and from the results cited herein, nothing definite can be stated as to whether there is an actual infectious disease caused by a protozoan micro-organism which THEILER classifies as *Anaplasma* or whether these marginal points are merely secondary effects from various conditions".

"There is a possibility that there is an infectious disease caused by *Anaplasma* and that there are bodies formed in the red blood cells from various other conditions which are so similar to *Anaplasma* in appearance and staining reaction, that they cannot be differentiated at the present time".

1178 - The Avenue of Invasion and the Behaviour of the Infection [of Contagious Abortion] in the Uterus. — WILLIAMS, W. J., in *Journal of the American Veterinary Medical Association*, Vol. LII, New Series, Vol. 5, No. 1, pp. 13-38. Ithaca, N. Y., October 1917.

A critical review and discussion of the facts noticed in this connection, and of the interpretations and theories to which they have given rise. The conclusions arrived at by the writer are as follows: the original portal of entry of the abortion infection into the system requires further study, but for the present, the evidence points to 2 great sources; 1) the intra-uterine infection of the foetus; 2) the contaminated milk fed to the newborn calf.

*Intra-uterine infection of the foetus.* — In the aborted foetus, investigators generally insist that the BANG bacillus is to be found primarily in the digestive tube, secondarily in the blood. They are silent regarding the other bacteria more commonly present. Like all chronic conditions, the abortion infection cannot uniformly, nor generally, end in prompt foetal death. The foetus, whether premature, or born at full term, must be largely infected at birth. HAGAN has traced this well, especially with a bacillus of the colon type, which he recognised in the utero-chorionic cavity of the cow, immediately after calving, and in the rumen and rectum of the new-born calf, though it was healthy in appearance. The calf bearing alimentary infection at the time of birth frequently dies in a few hours from acute sepsis, and yet more commonly develops calf scours and arthritis. Later, the survivors suffer from chronic arthritis, pneumonia and chronic scours. The best way to prevent such pre-natal infection is to disinfect the genital tube of the cow prior to breeding. This operation is difficult, but the technic has been greatly improved and if performed skilfully, conscientiously and perseveringly, sterility is checked by this operation, and much disease is repressed. The bull should also undergo preventive disinfection.

*Feeding the new-born calf with infected milk.* — The largest number of the BANG bacilli occur in the utero-chorionic space of the gravid uterus; at parturition they escape and contaminate the udder. The calf swallows the infection in sucking, or the milker gets it into the milk and feeds it to the calf. SCHROEDER and others have discovered the BANG bacillus in the milk within the udder, but infection from the exterior of the udder is much more frequent and dangerous. The best preventive measure is to disinfect the genital organs of the cow immediately after parturition, in order to free the udder from genital discharges, and restore the genital system of the mother preparatory to the next breeding. It has been found that once the foetus or calf are infected, the infection remains permanent, vacillating greatly in degree. It is especially significant that large groups of heifer calves suffering severely from scours and pneumonia abort very largely in their first pregnancy.

1179 — *Paspalum* and "Tembleque," in the Argentine (1). — GIROLA, C., in *Anale de la Sociedad rural Argentina*, Year LII, Vol. 41, No. 6, p. 459. Buenos-Aires, August, 1917.

Messrs. ROSENBUSCH and ZABALÀ had plants infested by the cryptogam they considered to be the cause of "tembleque" determined at the Biological Laboratory of the Argentine Ministry of Agriculture. Besides *Paspalum notatum* Flugge, these plants included *P. dilatatum* Poir., and perhaps other related species. They were all attacked by *Ustilagopsis deliquescens* Speg., which, besides the two above-mentioned species, also attacks *P. pumilum*, *P. quadrijarium*, *P. Larrañagai*, *P. giganteum*, etc.

(1) See R. September, 1917, No. 829; R. October, 1917, No. 924.

(Ed.)



1180 - **The Susceptibility of the Prairie Dog to Rabies.** — WALTERS, GEORGE, in *Journal of the American Veterinary Medical Association*, Vol. 41, New Series, Vol. 4, No. 5. pp. 702-704. Ithaca, N. Y., August, 1917.

In 1900, the Bureau of Animal Industry of the U. S. Department of Agriculture published a very complete account of the losses occasioned by the prairie dog, or prairie marmot (*Cynomys ludovicianus*) to the stock-breeders of the Southwestern States (Merriam C. Hart, *Year Book of the United States Department of Agriculture*, Washington, 1901). Numerous other papers referring to this *Sciurida* have since appeared, but none approach the problem from the hygienic standpoint. *C. ludovicianus* is essentially a "social" animal, living in immense colonies ranging from a few acres to thousands of square miles in area, the population averaging from 35 to 64 per acre. Their natural enemies are the coyote (*Canis latrans*), the badger, (*Meles taxus*), the black-footed ferret (*Putorius nigripes*), and a few denizens of the arid regions.

The prevalence of rabies among coyotes has recently been a subject of legislation and Health Department control in the West of the United States. The fact, which is shown by the writer in the article analysed, that *Cynomys ludovicianus* easily contracts rabies, and thus may spread the disease among coyotes, or catch it from them, is one of great practical importance. The vicious temperament of *Cynomys* (an animal which is very difficult to tame) led the writer to suspect that it would be a good subject of experimental rabies. He first inoculated 3 prairie dogs with anti-rabies vaccine and then with rabies virus. In 3 animals there was a positive reaction, and 2 died. The subsequent inoculations from the brain of these animals gave corroborative results.

1181 - **The Chicken Mite (*Dermanyssus gallinae*); Its Life History and Habits.** — WOOD, H. P., in U. S. Department of Agriculture, *Bulletin* No. 553, 14 pp., 2 fig., 1 plate. Washington, August, 1917.

*Object of the publication.* This is not to give an exhaustive study of the life-history of the chicken-mite (*Dermanyssus gallinae*), but to work out the main points in the life cycle of this pest and to discover principles upon which combative measures may be based (1).

*Rearing methods Used in Life-History Experiments.* A large earthen jar, in which a small roost was put, was utilised for a breeding cage. The jar was set in a pan of water, in order to prevent the escape of the mites, and a coarse-mesh wire screen was fastened over the top to hold the chicken in the jar. When it was desired to feed the mites, they were either dropped in the bottom of the jar, or else put on the fowl's back. Sheets of paper were placed at the bottom of the jar to collect the manure and some of the mites. Most of the fed mites were found about the roost in cracks prepared for them.

Moulting, mating and egg-laying took place in tubes or small vials. In case individuals were being watched, vials were used, and where many mites were confined, test tubes were used. The vials were plugged with

(1) See R. September 1917, No. 830.

(Ed.)



absorbent cotton covered with a small piece of black cloth, which latter facilitated the observation of the small white eggs and larvae. In the longevity experiments, varied conditions were supplied. Some of the mites were kept on moist sand; others in dry tubes, and others were on roosts. The results obtained are summarised by the writer as follows:

Blood is the necessary food of the mite in all stages except the larva, in which stage no food is taken. It takes from  $\frac{1}{2}$  hour to 1 hour for the mite to feed fully and leave the fowl; it then usually crawls off the fowl and finds a convenient crack or crevice in which moulting and mating take place. Females deposit an average of 4 eggs each at the rate of 4 in 24 hours. After finishing deposition, the females feed again, usually at night, one engorgement nearly always being sufficient for each deposition. When full of blood the female is elliptical in outline, plump and blood-red. Females will continue to feed and deposit 8 times at least, and possibly oftener. The female must copulate at least once before she will deposit fertile eggs, though fertilisation is not necessary before each deposition. The male does not feed directly after moulting as does the female, but stays in the cracks, no doubt to fertilise several females. The proportion of males to females is about one to two. The eggs hatch in 2 days (August). The larvae, which have only 3 pairs of legs, moult without feeding in about one day. The first meal is taken as a first-stage nymph. The first-stage nymph before feeding is light coloured like the larva, but is much more active. It becomes engorged with blood once only and is ready to moult. This stage required  $1\frac{1}{2}$  days. The second-stage nymph before feeding is rather greyish and like the preceding stage, is active. After one meal of blood and a moult the second-stage nymph becomes adult; previously, it is smaller than the adult, but much like the latter. All stages after feeding are blood-red. It requires  $1\frac{1}{2}$  days to bring the second-stage nymph to the adult. Unfed females are slightly larger than unfed males. Mites that do not get a chance to feed may live 4 or 5 months.

- 1182 — **Studies on the Metabolism of Fats in the United States.** — I. LYMAN, J. F., The Utilization of Palmitic Acid, Glyceryl Palmitate, and Ethyl Palmitate by the Dog, in *The Journal of Biological Chemistry*, Vol. XXXII, No. 1, pp. 7-11. Baltimore, October, 1917. — II. LYMAN, J. F., The Effect of Feeding Free Palmitic Acid, Glyceryl Palmitate and Ethyl Palmitate on the Depot Fat in the White Rat. *Ibid.*, pp. 13-16.

Experiments carried out at the Laboratory of Agricultural Chemistry, Ohio State University, Columbus, and at the Sheffield Laboratory of Physiological Chemistry, Yale University, New Haven.

I. — With two dogs the following utilisation values were obtained: lard, 96.7 and 96.5 per cent., ethyl palmitate, 58.8, and 50.9 per cent., glyceryl palmitate, 94.8 and 95.4, palmitic acid, 82.5 and 81.0. Emulsified esters of fatty acids are not absorbed as such, but absorption is limited by the rate of hydrolysis. While the corresponding esters of palmitic and stearic acids do not differ markedly as to melting points, the ethyl esters of both being liquids and the glyceryl esters being solids at body temperature, still there is a wide difference as to digestibility. The melting point of the ester is therefore not the only factor, probably not the chief factor, determining

the rate of hydrolysis and absorption. The writer suggests that the nature of the fatty acid radicle of an ester has an effect on digestibility, aside from its effect on the melting point of the compound. Experiments are in progress to determine this point.

II. — After feeding free palmitic acid, glyceryl palmitate, or ethyl palmitate to white rats, essentially the same kind of fat is stored in the fat depots and it consists largely of tripalmitin. Neither free palmitic acid, nor ethyl palmitate in appreciable amounts is deposited unchanged in the fat depots. The fat deposited as a result of feeding the animals on a fat-poor diet differs markedly from that laid down when the diets contain palmitic acid or its esters.

1183 — **A Study of Methods of Estimation of Metabolic Nitrogen.** — FORBES, E. B., MANGELS, C. E. and MORGAN, I. E. (Ohio Agricultural Experiment Station), in *The Journal of Agricultural Research*, Vol. IX, No. 12, pp. 405-411. Washington, D. C., June 18, 1917.

The so-called metabolic nitrogen of the faeces is that portion which has an origin other than as an undigested food residue. It consists of residues from the bile and digestive juices, of epithelium and mucus from the digestive tract, and of such products of bacterial activity as have been derived from digested or from digestible nitrogen. In determining the digestibility of protein — a matter of great importance in relation to practical animal nutrition — the metabolic fraction of nitrogen of the faeces is an important factor.

The plan of this experiment was to feed a basal ration of corn alone to each of five pigs during the first period, and to add to this corn ration in subsequent periods entirely digestible protein, in form of milk, blood albumen, and commercial dried egg albumen, to be used in comparing methods of estimation of metabolic nitrogen; these methods were: 1) the acid-pepsin method; 2) the acid-pepsin and alkaline-pancreatin method; and 3) the alcohol, ether, hot water, and cold lime-water method (JORDAN).

The results obtained may be summarised as follows:

The apparent digestibility of the protein of corn, based on the total nitrogen of the faeces is about 75 per cent. On account of the existence in the faeces of nitrogen of metabolic origin the real digestibility must be higher. The acid-pepsin method makes it appear that the real digestibility of the protein of corn is about 92 per cent., and the pepsin-pancreatin method about 96 per cent. JORDAN'S method gives appreciably lower figures, averaging 86 per cent.

The acid-pepsin method indicates that 70 per cent. the pepsin-pancreatin method 84 per cent., and the Jordan method 46 per cent. of the nitrogen of the faeces from corn is of metabolic origin.

All the methods make the nitrogen of blood albumen appear more than completely digestible, even the apparent digestibility being over 100 per cent.; thus, the feeding of blood albumen with corn seems to increase the digestibility of the corn protein to an extent more than sufficient to offset the incomplete digestibility of the protein of this supplement.

With skim milk the apparent digestibility varies from 95.97 to 104.44



per cent., the average being 99.15. The proteins of skim milk are made to appear more nearly completely digestible by the acid pepsin method than by the pepsin-pancreatin method or by the Jordan method.

With egg albumen the results varied considerably, but all were high. It would appear that raw, commercial, dried egg albumen is almost perfectly digested by swine.

Important inaccuracy seems to be inevitable in any determination of digestibility of supplementary foods in the usual way, by difference; and no other method seems more satisfactory.

The digestion coefficients for protein involved in the feeding standards of reference works on animal production assume that the nitrogen of the feces is entirely an indigestible food residue. The rough measures afforded by the results of this study indicate that, as applying to the digestive capacities of swine, this assumption underestimates the digestibility of protein by about 20 %. In attempting to choose between the methods investigated it seems that the acid-pepsin and the pepsin-pancreatin methods give results which are more nearly true than does Jordan's method, since the latter does not digest the bacteria, which may contain large proportions of the nitrogen of the feces and which presumably are more largely the product of digestible than of indigestible protein.

There is so far no accurate scientific basis for the determination of the digestibility of protein.

1184 — **A Comparative Study of the Feeding of Cattle and Pigs with Regard to Meat-Production.** — GOUIN, A. and ANDOUARD, P., in *Le Génie Civil*, Vol. LXXI, No. 40, pp. 157-158. Paris, September 8, 1917.

FEEDS  
AND FEEDING

Studies extending over more than 15 years have shown that, in cattle, for each kilogram (1) gain of live weight, the growth requires 500 gm. of food material per 100 kilos body weight. Thus, while the requirement of growth is only equal to the material incorporated by a 75 kg. calf, it is more than 5  $\frac{1}{2}$  times that amount in a 400-kg. animal.

No matter how quickly growth takes place, the amount required always remains the same.

Much greater than the growth requirement is that of maintenance, which consists in replacing worn-out tissues and maintaining body heat. The writers have found that, for cattle, this requirement is 500 gm. of food material per sq. metre of body surface per animal. The surface of an animal  $S$  as a function of the weight  $P$ , determined experimentally by the

writers in 1915 on a slaughtered animal, is:  $S_1^2 = 9.67 \times P_1^{\frac{2}{3}}$ .

Recently, the University of Missouri (U. S. A.) has carried out similar researches on a number of animals. The results fully confirm those obtained by the writers:

Weight in kg.	correspond to 208 sq. decimeters.
200	331
300	433
400	525
500	609

(1) 1 kilogram = 2.2 lbs.



The surface area increases less quickly than the weight; the maintenance requirement decreases in proportion as the animals approach full growth.

According to the above remarks on the importance of the maintenance and growth requirements, the gain of 1 kg. per day requires the amounts of food material shown in Table I.

TABLE I. — *Amount of food material required to obtain a gain in live-weight of 1 kg per day.*

Live weight	Materials	Growth requirements		
		Work of converting the materials	Daily maintenance	Total
100 kg.	370 grm.	500 grm.	1 370 grm.	2 240 grm.
200	370	1 000	2 060	3 430
300	370	1 500	2 706	4 576
400	370	2 000	3 281	5 651
500	370	2 500	4 306	7 176

In the case of a 100-kg. calf which has gained 400 kg. in 500 days, the animal would have required 1830 kg. of food material, and would have consumed, on a high-scale ration, 2000 kg. of hay containing 45 % of available food material, and 1200 kg. of cake with 78 %, as was found from experiments carried out by the writers for 13 years.

TABLE II. — *Comparison of results obtained by feeding 1 bullock and 3 pigs.*

	1 bullock	3 pigs
Cake consumed . . . . .	1 200 kg.	1 200 kg.
Total growth . . . . .	400 kg.	330 kg.
Net meat . . . . .	200 kg.	247.5 kg.
Quality of meat . . . . .	not ready for slaughtering	very good.
Time required . . . . .	500 days.	165 days.
Additional foodstuffs . . . . .	2 000 kg. hay	35 kg. bone meal
Cost of cake . . . . .	504 fr.	504 fr.
Cost of other foodstuffs . . . . .	240 fr.	14 fr.
	744 fr.	518 fr.
Cost price of 1 kg. of meat . . . . .	3.72 fr.	2.09 fr.
Value of 1 kg. of meat (August 5, 1917). . . . .	3.20 fr.	4.40 fr.

Taking hay at 12 fr. (1) per 100 kg. and cake at 42 fr. the breeder would have spent 744 fr. for a gain of 400 kg. that is, 1.8 fr. per kg. of live weight not fattened. On the contrary to the calf, whose daily growth attains its maximum from the day after birth, the young pig produced by a multiparous sow at first grows only slowly. It is only after 2 months from healthy birth that one can count on a nearly uniform gain of 700 grm. per day, with

(1) 1 franc = 9.52 pence.

fairly early-maturity breeds and abundant feeding. With a high-scale ration, porkers can easily increase from 25 to 135 kilos in from 160 to 165 days, consuming 400 kg. of concentrated foods. The 1200 kg. of these food-stuffs required by a single bullock would suffice for 3 pigs.

If the utilisation of cakes in the shippon and the pig-sty are compared, the differences will be found as shown in Table II.

Under present conditions, the interest of the breeder coincides with that of the public in giving the preference to pig-breeding. The immediate breeding of large numbers of pigs is the sole method for quickly reducing the shortage of meat.

With 250 porkers, 100 tons of ground-nut and palm-nut cake with 3 tons of bone meal, can be converted, in 6 months, to 20 000 kg. of meat suitably fattened.

**1185 - Horsechestnuts as a Food for Farm Animals** (1). — I. DECHAMBRE, II. VACHER, MARCEL, III. LINDET, IV. TISSERAND, in *Comptes rendus des Séances de l'Académie d'Agriculture de France*, Vol. 3, No. 32, pp. 926-941. Paris, October 24, 1917.

I. — M. DECHAMBRE, commissioned by the Academy to prepare a report on the question of the utilisation of the horsechestnut raised by the papers of M. PHILIPPE DE VILMORIN and M. GAIN, has collected information in order to make clear the knowledge we at present possess of the food value of this product and its practical use. In his report to the Academy he first describes previous experiments and their results, then those carried out quite recently under his direction, particularly at the National School of Agriculture of Grignon.

The results of these experiments show that fresh *crushed* horsechestnut may well be fed to sheep in quantities varying between 1 and 2 lbs. per head. Cooked by steam or in a boiler, they may, after the water in which they are cooked has been removed, be fed to fattening cattle in quantities up to 6 ½ lbs. per head. They have no effect on the quality of the milk in dairy cows.

In the form of flour, after being ground, and dried so as to get rid of the bitter element, 2 lbs. per head may be given to pigs in their mash. In this form, or after being cooked, they may be fed to poultry, to which they are not suited when raw, even acting as a violent poison to ducks.

II. — M. MARCEL VACHER only got pigs to accept horsechestnuts after the nuts had been boiled in an autoclave with potatoes, the proportion of chestnuts not exceeding 10 %.

III. — M. LINDET states that horsechestnuts ferment very rapidly giving a large proportion of alcohol : 80 lbs. of chestnuts give 1 gallon of alcohol.

IV. — M. TISSERAND points out that at the Rambouillet National sheep-farm horsechestnuts have always been included in the normal ration of the sheep.

**1186. - Chemical Composition and Food Value of the Grass and Hay of *Andropogon rufus* Kunth.** — See No. 1154 of this *Review*.

(2) See R. October, 1917, No. 954.

(Ed.)



## BREEDING

**1187 - The Abderhalden Test for Pregnancy in Animals** (1). — ZELL, C. A., in *Journal of the American Veterinary Medical Association*, Vol. III, New Series, Vol. V, No. 1. pp. 39-47. Ithaca, N. Y., October, 1917.

The **ABDERHALDEN** test is based on the determination of the presence, or absence, in the serum of ferments capable of digesting placental albumins which are believed to be somewhat disharmonious substances present in the blood-stream only during pregnancy. The animal organism permits only material that has been put in harmony with the body, and particularly the plasma, to reach the circulation. The cells of the intestine and liver especially act as important sorters for the whole organism.

If insufficiently transformed substances penetrate into the general circulation, we must expect troubles of all kinds. In such a case, the organism defends itself against injury, and produces certain agents against the disturbing elements, *i. e.*, defensive ferments.

**ABDERHALDEN** explains the existence of such defensive ferments during pregnancy as follows: the organism of the mother has at its disposal, up to the appearance of pregnancy, a certain amount of cells of a particular kind, which all harmonise with each other in their metabolism. After conception, there appears an entirely new kind of cell which have to perform particular duties. Although the impregnated egg and developing placenta with all its various cells are in harmony with the species, nevertheless the metabolism of all these cells is something new and foreign to the complex of cells composing the organism of the mother. The blood probably receives substances, perhaps also secretions, which are out of harmony with the plasma and remain so, the time being too short for the blood to accustom itself entirely to these new substances. At the expulsion of the placenta, in which process fermentations probably play a preparatory part, the ferments quickly disappear.

These ferments may be demonstrated within about 8 days after impregnation, and they disappear within 14-21 days after expulsion of the placenta. These ferments are strictly specific.

A positive test with placenta fundaments (the tests with other substrata being negative) means the presence of specific ferments for placental albumins, from which we infer that the animal harbours placental elements. It does not necessarily mean pregnancy, however, as the positive reaction may be due to retention of some syncytial cells in the uterus, hydatiform moles and chorioepithelium. Animals suffering from pneumonia and pleurisy with a particularly high leucocytic count, gave a somewhat confusing weakly positive reaction to placental tissue; such animals cannot serve for an **ABDERHALDEN** test.

After **ABDERHALDEN** published his first article on the defensive ferments of the animal organism (in 1913), a large number of publications appeared all over the world, some for and some against the test.

The writer carried out his tests with careful attention to the technic which he describes). Of the 497 tests, 260 were experimental. From the results obtained, he draws the following conclusions:

1) See also *B.* 1915, No. 408.



1) The **ABDERHALDEN** test for pregnancy in animals is very reliable, if a scrupulously exact technic is employed.

2) Much care should be taken in preparing the substrates, or fundaments, and in the selection and use of dialysers.

3) The blood which is to be examined must be taken in an absolute stage of hunger, and must be free from haemoglobin and blood corpuscles, and from all contamination.

4) Whenever possible, the animal should be examined for the presence or absence of any kind of leucocytosis.

**1188 - Heredity, Causes and Importance of White Marks on the Coats of Equine Animals; Research in Italy.**— **GUGNONI, CESARE**, in *Giornale d'Ippologia*, Year XXX, Nos. 17, 18, 19, 20. Pisa, September, October, November, 1917.

Attention is first drawn to the work of **VALVASSORI**, **PUCCI** and **TORREGIANI** on the white marks on the legs of white and grey horses, and of mules, and that of **LANG**, **ANDERSON**, **WALTHER** and **WENTWORTH** on the same subject. A study of the results obtained with the Hackney stallion "Polonius," a roan chestnut of the Pisa stallion stables, which has a white mark on its side, confirm the supposition that hereditary transmission of the marking varies with its extent. Thus, widely spread marking of the body is dominant; that which is limited to a few small marks on the body follows no rule of hereditary transmission. This also applies to white marks on the legs, stars, etc. in pure breeds of horses.

*Marks on the coats of asses.* — The experiments of **JENKS** in Arizona and Texas are first quoted. The case of a Sardinian she-ass resembling an albino is then described. Served by an ordinary ass it had a son which was coloured all over, as in the case of other mammals (rabbits, rats, guinea pigs); in these, contrary to the case of the horse, the factor of complete colouration, except with rare exceptions, is dominant to its allelomorph, and is expressed by partial albinism. In this case, the character "albinism over the whole body" acted, in relation to complete colouration of the body, in a manner diametrically opposed to the partial albinism of the horse.

*Marks on the coats of mules.* — After giving the different proportions of marked mules in the various producing countries, the author divides mules having white marks on the legs into two classes:

1) Mules with white marks on their legs, born by marked mares; these are the most common and their marks are very large.

2) Mules with white marks on their legs, descended from asses and horses both of which have permanent white marks; these are more rare and, in most cases, their marks are smaller.

According to the author's observations and data, the mark at the base of the tail should be included among those most likely to be transmitted in the cross ass  $\times$  marked mare. The nerve parts which, in equine as in other animals, have the least tendency to produce pigment are those of the limbs, the centre line of the fore part of the head, the tail and the base of the tail.

The facts observed in connection with the hereditary transmission of white marks in the cross ass  $\times$  mare, lead to the supposition that by cross-

ing the horse with other equines, represented by animals influenced either but slightly or not at all by domestication, there is also less chance of transmitting this character. However, the results of later experiments must be awaited before it is possible to conclude in favour of the dominance of the factor of complete colouration of the coat of undomesticated equines over that of the marking of the trunk of the horse.

After describing the different types of white marks on the coats of equines and the manner of their transmission, either by pure-breeding or by crossing, the author studies the importance of these characters and the causes determining their apparition. To this effect he considers the action of environment on the production of marked animals and the relation between organic resistance and albinism in its varying degrees.

STOCK RAISING:  
ORGANISATION  
AND  
ENCOURAGE-  
MENT

**1189 - Prospects for American Purebreds.** — WENTWORTH, E. N., in *The Field Illustrated*, Vol. XXVII, No. 3, pp. 182-183 and 212. New York, March, 1917.

The pure bred animals of America, according to the writer's estimate, represent only 2.46 % of the American livestock industry, as shown by the following table.

Kind of stock	Total Number in U. S. (Jan. 1, 1916)	Total Number pure breeds (Jan. 1, 1916)		% pure breeds (Jan. 1, 1916)
		Registered	Unregistered	
Horses . . . . .	21 166 000	171 200	14 340	0.88
Beef cattle . . . . .	39 453 000	812 000	243 600	2.69
Dairy cattle . . . . .	21 998 000	567 000	170 000	3.36
Sheep . . . . .	49 162 000	354 000	141 600	1.07
Swine . . . . .	68 047 000	1 220 000	1 220 000	3.58
Total . . . . .	199 826 000	3 124 200	1 789 540	2.46

These pure bred animals constitute the foundation stock. Each has been improved to perform a certain function better than the average of its species, and its value is measured by the degree to which it can transmit this performance to its offspring. Pure bred males are of two classes: those whose function will be to sire only market animals, and those whose function will be to sire more seed stock. As far as numbers are concerned the first class is predominant, although constructive breeding, even the future of breeds themselves, depends on the few reserved for the second purpose. Approximately 90 to 95 per cent. of males are included in the first class, draft horses alone excepted, while only 5 to 10 per cent. belong to the second. In fact this restriction is so great, that only 3 to 5 per cent. of all registered animals living four or five generations ago are enumerated in modern pedigrees. There are therefore two types of livestock men in America: the constructive breeders and the producers. If the pure breeds America has today can supply the necessary sires for the production herds, as well as the necessary seed stock, the demand will be fulfilled. As a matter of fact, this demand is not supplied at present, witness the



exceptional auction prices of the last few years. Hence a healthy growth in the number of pure breeds may be expected. Seed stock will still be needed and there will be room for thousands of additional breeders. Provided that the stockman is not a speculator, there is no business in which future success is more certain; 2.46 % of pure breeds where 5 to 7 % may be necessary is a margin of surety for years to come for all careful and conservative American breeders.

1190- **The Rehabilitation of the Milking Shorthorn in the United States.** — WEIS, P., in *The Breeder's Gazette*, Vol. LXXII, No. 12, pp. 324-326. Chicago, September 20, 1917.

CATTLE

It is a significant fact that the controversy about the Milking Shorthorn breed ceased almost simultaneously with the beginning of the rise in beef prices. Until two years ago even authorities on the dual-purpose question believed quite generally that the breed would be confined to the east and northwest of the United States and to the general farmer. But when the first volume of the Milking Shorthorn Yearbook was compiled by the American Shorthorn Breeders' Association two years ago the fact was revealed that the breed was not confined to those parts of the country only but was beginning to make friends everywhere. Today the call for breeding stock is almost as strong in the south as in the north.

There is no doubt that if breeders of Milking Shorthorns would have followed the policies of breeders of dairy cattle in advertising their breed by the creation of a number of phenomenal milk records, progress would have been made more rapidly. That this would have been possible is shown by the attainment of a number of high records such as Rose of Glenside's 18 075 pounds of milk in a year, and others, but breeders of the dual purpose Shorthorn are laying more stress on the attainment of moderate long distance records under ordinary farm conditions rather than on the attainment of short-time phenomenal records made under the most favourable conditions.

At the close of 1916 the Record of Merit list for the breed contained the names of 427 animals. Of this number 99 cows have made more than 10 000 lbs of milk a year, and 278 well over 8 000 and under 10 000 lbs. During this year a large number of Shorthorn cows has been put under official test and there will be a perceptible increase of animals with authentic milk records at the end of 1917.

There were about 260 breeders of milking Shorthorns at the beginning of 1917 distributed over 33 states, and indications are that the year will close with well above 300 breeders in every State of the Union.

The first public sale of milking Shorthorns was held in America in March, 1916; an average of \$ 562 was realized on 54 head. The second sale resulted in an average of \$ 751. Prevailing prices for dual-purpose Shorthorns are a fair reflection of the rapidly increasing demand for this kind of stock.

If breeders keep up their efforts toward a still better and more beautiful animal, their ultimate success in the complete rehabilitation of the breed will be but a matter of a few years.



## POULTRY

1191 - The 15th. Egg-Laying Test at Hawkesbury Agricultural College, New South Wales, April 1, 1916 - March 31, 1917. — ROSS, G. D. and HADLINGTON, JAS., in *Department of Agriculture, New South Wales, Farmers' Bulletin* No. 114, pp. 21. Sydney, July, 1917.

The 15th egg-laying competition gave better results than all previous ones, both as regards general excellence and the records of groups and individual hens. The mortality also was very low; these facts taken together are an indisputable evidence of progress in 15 years of continual selection.

As many as 540 fowls took part in the competition; 420 were first-year hens, and 120 second-year hens. Of the former 240 belonged to light breeds, and 180 to heavy breeds. The first-year hens were kept separate and tested individually, while the second-year birds were still tested in groups of 6. The general results were as follows:

*Results of 15th Egg-Laying Competition at Hawkesbury Agricultural College.*

First-year Hens		Second-year Hens		
Varieties	Eggs per hen	Varieties	Eggs per Hen	
			in 1915-1916	in 1916-1917
<i>Light Breeds:</i>				
210 White Leghorns . . . .	219	84 White Leghorns. . .	213.9	168.4
18 Chinese Langshans. . .	219	—	—	—
6 Sicilian Buttercups . . .	154	—	—	—
6 Black Leghorns . . . .	159	—	—	—
<i>Heavy Breeds:</i>				
108 Black Orpingtons . . .	194	30 Black Orpingtons . .	207.2	162.8
12 Plymouth Roks . . . .	209	—	—	—
36 Rhode Island Reds . . .	179	—	—	—
18 Silver Wyandottes . . .	203	6 Silver Wyandottes. .	232.8	133.5
6 Sussex Reds . . . . .	164	—	—	—

Of the first-year section, the light breeds gave, as an average per hen, 216 eggs, and the highest total per group (6 White Leghorns) was 1526 eggs, or 254 per bird. Only 2 groups failed to reach the total of 1000 eggs. The heavy breeds gave a maximum of 312 eggs per hen, and 1479 eggs per group, or 246 eggs per hen. The number of 312 eggs in one year beat the previous worlds' record obtained at Oregon Agricultural College. The second place belonged to a fowl which laid 308 eggs; many laid nearly 300. One Black Orpington laid 2 normal eggs on May 5, 8, 10, and 15, 1916, and always laid 1 normal egg the day before and the day after she laid the 2 eggs. The general number of eggs per hen in the light breed and heavy breed sections is 205.8 per fowl; this beat the record previously obtained at Hawkesbury in 1910, which was 184 eggs per fowl as a general average of all the hens competing. These remarkable results are due in part to the great care taken of the hens, but also largely to the fact that the birds were of pure

selected breeds. The food given consisted of the following rations given *ad libitum* :

*Morning mash*: 22 oz of common salt dissolved in the water with which the mash was mixed; 60 lbs. pollard; 20 lbs. bran; 12 lbs. lucerne dust; 8 lbs. meat or blood meal.

*Evening ration of grain*:  $\frac{2}{3}$  wheat;  $\frac{1}{3}$  crushed maize.

The average cost of feeding the 540 hens for one year was 6s. 7d.; the difference between the price at which the eggs were sold and the feeding-cost was 14s. 11d. per hen.

1192 — Brazilian Ducks: “pato do matto” (*Sarcidiornis carunculata*) and “pato bravo” (*Cairina moschata*) (1). — *Chacaras e Quintaes*, Year VIII, Vol. XVI, No. 2, pp. 105-107 + 1 coloured plate. São Paulo, August, 1917.

*Sarcidiornis carunculata*, called in Brazil “pato do matto” or “pato de crista”, and in the Amazon district, “pato de Cayenna” and “pato castelhano”, is common in the coastal region of Brazil and the Amazon district. Its flesh is very tender, but it is not adapted to domestic rearing. It is shot during the period when it moults its wing feathers, as then it cannot fly very high.

*Cairina moschata*, which, according to the Author, is derived from the preceding species, is called in Brazil “pato” or “pato bravo” (wild duck), or “pato domestico” (domestic duck), according to whether it is wild or domesticated. It is the muscovy, or musk-duck (in French “canard muet” in Italian “anatra moscata”), and is found throughout Brazil. When wild, its plumage is green-black with metallic reflections, and the breast and abdomen are white. As the birds grow old, the white colour spreads more and more, and sometimes covers the whole plumage. This duck is easily bred and does not require particular attention; all that is necessary is that the young be protected from damp at the time of the heavy rains. *Cairinia moschata* grows more rapidly even than rabbits; at 3 months some will give 6  $\frac{1}{2}$  lbs. of very delicate meat. On account of their slight flavour of musk the eggs are chiefly used in pastry-making, for which they are in great demand.

The cross between the “pato” and “marreco”, called in northern Brazil “patury” or “paturola”, produces an excellent tender and tasty flesh. Its breeding for this purpose is recommended.

1193 — The Advantages of Full Sheets and Bottom Starters in Sections. — GREINER, G. C., in *American Bee Journal*, Vol. LVII, No. 4, p. 129, 4 figs. Hamilton, April, 1917.

BEE-KEEPING

In order to obtain regular combs bottom starters are advocated. When starting only from the top the frames are incompletely fitted and the bees

(1) *Sarcidiornis carunculata*, of Brazil, Paraguay and the north of the Argentine, and *Cairina moschata* are found from Mexico to the Argentine and belong to the family of *Anatidae*, sub-family *Plectropterinae*. The first of these birds perches on trees and nests in the hollows of trunks; it lays a dozen white-shelled eggs, and sometimes more. The second is often bred in the waters of parks and gardens. — Cf. *The Cambridge Natural History*, Vol. IX, Birds, p. 134. London, Macmillan and Co., 1909. (Ed.)



finish them much as in the old hives. On the other hand, when bottom starters are used, the lower part of the comb fills the whole width of the frame, thus increasing the honey production. Starting from the bottom does not exclude starting from the top. It was seen that bees build up the comb from both ends at the same time, and join the two parts when they meet.

## SERICULTURE

1194 - The "Black Worm" Silkworm of Cambodge. — GACHON, in the *Bulletin Economique de l'Indochine*, Year 20, New Series, No. 125, pp. 301-302. Hanoi-Haiphong, July-August, 1917.

In the course of a journey through Cambodge in June 1916, the Author (Inspector of the agricultural and commercial Services of Indochina) noticed in silkworm rearings, in certain villages, larvae of a dark, bottlegreen colour among the common larvae with yellow cocoons of the polyvoltine Indochinese race.

The larvae, known locally as "black worms" are, according to the natives, more vigorous than those of the ordinary race and are also more resistant to the great heat and to the humidity of the monsoon seasons. Their cocoons are very similar to these of ordinary larvae, but the writer thinks they are of finer and less satiny staple.

The rearing of these "black larvae" is confined almost exclusively to certain districts.

Some dozens of cocoons were brought to Tonkin, many hatching out on board ship while sailing from Saigon to Haiphong. There seemed to be no sensible difference between the male and female moths of this and the ordinary Indochinese race.

The larvae obtained from eggs laid by these moths were reared in an experimental nursery at Kiên-an. The first rearings took place in August and gave good results, as did the second, carried out in September. The larvae resisted the high temperatures and the storms of the months of August and September very well, showing no traces of the diseases ever becoming more common in summer rearings ("flacherie", "grasse", etc.).

The moths resulting from the second rearing were crossed in October with moths of the Tonkin breed, negative results being obtained; the progeny was always clearly separable into half "black larvae" and half native larvae. Further attempts in November and December gave no better results.

The pure race of "black larvae" suffered greatly from cold in January, although reared in a heated nursery; they remained weakly, and produced small, poor cocoons.

In February and March all the "black larvae" died. It should be remarked, however, that these winter rearings were carried out by natives alone, with no guidance or supervision of an European expert.

The writer thinks that the experiments should be repeated, on account of the unfavourable conditions of 1916.

If it is found that the "black larvae" from Cambodge behave better than the native ones during the hot and stormy season from June to Sep-



tember, it would be worth while breeding them at Tonkin. The eggs could be preserved in cold-storage during the winter and spring, or else rearing might be continued in special heated nurseries, or again, a certain number of eggs of this variety might be brought from Cambodia about the end of May.

1195 - **The Use of Viper's Grass in Feeding the Mulberry Silkworm.** -- LAMBERT, F., in *Annales de l'Ecole Nationale d'Agriculture de Montpellier*, New Series, Vol. XV, Pt. I-II-III, pp. 12-19. Montpellier, July, 1915 to January, 1917.

This paper passes in rapid review many experiments in the feeding of *Bombyx mori* with various leaves (including those of the mulberry). They were carried out in different countries from 1826 onwards, and refer particularly to viper's grass (*Scorzonera hispanica*); salsify (*Tragopogon porrifolius*); colt's foot (*Tussilago Farfara*); dandelion (*Taraxacum Dens leonis*); silkworm thorn (*Cudrania triloba*) (these last experiments have been continued uninterruptedly for 10 years by the author, director of the Montpellier Sericulture Station); etc.

The author draws the following conclusions:

When viper's grass leaves are fed to mulberry silkworms, they first of all absolutely refuse them; later, forced by hunger, they taste and eat them. Usually these larvae die before spinning their silk. It is only rarely that a few cocoons are obtained, and that, from these cocoons, issue moths which lay eggs.

The larvae from the eggs laid by these survivors will accept viper's grass more readily than their parents, and the larvae of the following generation will accept it yet more readily.

From generation to generation an increasing number of larvae spin their cocoons, and it would thus seem possible, after a certain number of generations, to obtain a breed of silkworms which will adapt itself fairly well to viper's grass leaves. In a similar way, at Montpellier, the author successfully accustomed larvae of a French breed to eat the leaves of *Cudrania triloba*, used since time immemorial by Se-tchouen breeders to feed their larvae from the first stages onwards. After 10 consecutive years of experiments, larvae thus fed gave cocoons weighing, on an average, 0.924 gm., whereas the average weight of the cocoons of mulberry-fed larvae is 2 grms. Nevertheless, *Cudrania* resembles mulberry much more closely than viper's grass. The cocoons obtained with this latter plant would, therefore, apparently be at least equally unsatisfactory.

These results show the possibility of the transmission and increase, by heredity, of the capacity of the silkworm to live on a food foreign to its customary food, the mulberry. These facts, interesting from a theoretical point of view, might perhaps be applied practically in countries where the climatic conditions are not adapted to the cultivation of the mulberry for the production of cocoons, but appear completely void of technical interest in those where the mulberry grows well, and can bear, without much damage, repeated defoliation.

The mulberry, an essential foodstuff of the silkworm, is as superior in all other respects to the various plants which have been tested as as

substitute for the feeding of *Bombyx mori* (Osage orange, paper mulberry, *Cudrania*, viper's grass, etc.) as *Bombyx mori* is to the wild silkworms of the oak, ailanthus, plum, etc. in the production of silk.

1196 — **French Eggs and the Cultivation of Silkworms in Persia.** — SECRETAIN, C., in *Annales de l'Ecole Nationale d'Agriculture de Montpellier*, Vol. XV, Pt. I, II, III, pp. 2040. Montpellier, July, 1915 to January, 1917.

The author studies the following questions with reference to Persia: Importance of the trade in eggs in that country; the importation of French eggs; method of selling the eggs in Persia; conditions under which French eggs do well in Persia; the climate of the Ghilan; choice of breed; choice of eggs; the packing of the eggs, the forwarding of the eggs; sale of the eggs. He comes to the following conclusions: To capture the Persian egg market it is necessary: 1) to act without delay; 2) to supply a strong breed well suited to the climate; 3) to procure good eggs; 4) to form a general export Syndicate; 5) to choose good representatives.

1197 — **The Selection of Cocoons in Silkworm Rearing.** — See No. 1210 of this Review.

## FISH CULTURE

1198 — **The Work of the Madras Government Fishery Department in British India During the Year 1915-1916.** — *Bulletin of the Imperial Institute*, Vol. XII, No. 1, pp. 113-114. London, January to March, 1917.

For many years, the Madras Government Fishery Department has been successfully engaged in developing the sardine-oil and guano industry. Experiments with this object in view were carried out as far back as 1911-1912 at the Cannamore Experimental Station, and since that date at the Tanur Experimental Station. While in 1909, there was only one private factory of fish guano and oil, there were 50 in 1911-1912, and 250 in 1915-1916. The method of preparation in the small factories was extremely simple. The sardines are boiled in open caldrons of a capacity of about 500-750 kg. The resulting mass is placed in sacks of coco-fibre and pressed in ordinary screw-presses. The guano cakes are broken up and spread in the sun to dry. The oil thus obtained is crude brown oil; it can be refined by separating out the clear oil by means of brown, soft, stearine. Many samples of these products have been examined at the Imperial Institute (London). Tables I and II reproduce some of the analytic data.

TABLE I. — *Composition of Sardine Oil from the Presidency of Madras.*

	Brown oil with stearine	Brown oil without stearine
Specific weight at $\frac{100^{\circ}\text{C}}{15.5^{\circ}\text{C}}$ . . . . .	0.881	0.879
Acid Index . . . . .	12.1	11.8
Saponification Index (approximate) . . . . .	200.2	200.0
Iodine Index . . . . .	155.2%	154.1%



TABLE II — *Composition of 3 Samples of Fish Guano from the Madras Presidency.*

	I	II	III
<i>Percentage Composition of guano:</i>			
Moisture. . . . .	7.86 %	8.82 %	8.68 %
Crude protein . . . . .	49.22	53.65	56.40
Actual protein . . . . .	43.75	45.41	49.06
Other nitrogenous matter . . . . .	5.47	8.24	7.34
Fatty matter. . . . .	6.69	5.38	8.52
Other organic substances . . . . .	7.37	4.73	5.01
Ash. . . . .	28.86	27.42	21.39
<i>Composition of Ash:</i>			
Calcium (Ca O) . . . . .	33.10 %	42.32 %	41.12 %
Potassium (K <sub>2</sub> O) . . . . .	0.85	2.17	2.19
Phosphoric acid (P <sub>2</sub> O <sub>5</sub> ) . . . . .	29.52	35.32	35.56
<i>Composition of ash calculated as guano:</i>			
Calcium. . . . .	9.6 %	11.6 %	9.0 %
Nitrogen . . . . .	7.8	8.6	9.0
Phosphoric acid . . . . .	8.5	9.7	7.6

This sardine oil can be used for the same purposes as other fish oils; the stearine is also used in tanning and soap manufacture. Guano is a good fertiliser, it is less rich in protein than the fish meals sold in Europe as concentrated foods, which have a protein percentage of from 50 to 70, but it contains an average quantity of phosphoric acid and fatty matter, and thus can well be used for making fish meal for stock feeding, provided the fish used in its preparation is fresh, and the guano carefully made.

The Tanur experimental station is also engaged in curing fish. In 1915-1916, experiments were made in pickling mackerel (*Scomber scombrus*) with salt and with vinegar and spices.

At the Beypore cannery an experiment was made in storing fish in tins by means of solar heat. The tins were placed in a stout teak box, blacked inside, with a close-fitting double-glass top, the whole being insulated by being placed in a case with double walls. A midday temperature of 240° - 275° F. (115-135° C.) was readily attained by using the direct rays of the sun, and by means of a single mirror, a temperature of 290° F. (135.6° C.) was reached. The storing of the tins in this apparatus is stated to have been excellent.

The work of the piscicultural expert was devoted entirely to : — breeding fresh-water fish, both indigenous and exotic ; stocking tanks ; the introduction of fish for the destruction of mosquito larvae ; the inspection of various rivers.



The marine Biologist is concerned with the : exploitation of the Government monopolies of the pearl and chank fisheries ; commercial improvement of marine industries ; economic improvement of the fishing population ; educational work ; investigation of the life-histories of food fishes and their enemies, and related subjects.

Considerable progress has been reported in the Chank-fishing (*Turbinella pyrum*) industry. These shells are largely used for making bangles in Madras ; the usual method of cutting by hand is laborious and costly, but, as the result of enquiries at the Imperial Institute, it was found that a type of machine-saw used for cutting *Trochas* shells was quite suitable for cutting *Turbinella pyrum*.

An important feature of the work of the Department is an experimental soap works, which is under the control of a trained chemist. In addition to ordinary and toilet soaps, fish-oil and fish-oil-rosin soaps have been made for use as insecticides. The latter have been favourably reported on by the Government Entomologist, and are in considerable demand. In 1916-1917 the work of the Laboratory will be extended to include: glycerin recovery ; the possible utilisation of some of the lesser-known oils and fats, and indigenous perfumes and colouring matters.

1199 — A New Disease of the Sprat (*Clupea Spratta*) Due to a Parasitic Copepod (*Lernæenicus sardinae*). = BAUDOUIN, M., in *Comptes Rendus des Séances de l'Académie des Sciences*, Vol. 165., No 13, pp. 410-411. Paris, September 24, 1917.

It has been known since the publication of Mr. L. JOUBIN'S Mémoires (*Comptes Rendus de l'Académie des Sciences*, Vol. 127, p. 842 and p. 1177, November 19 and December 31, 1888), that *Lernæenicus sardinae*, the Copepod parasite of the sardine, can, by attaching itself to the sides of this fish, produce the formation of sub-cutaneous or intramuscular abscesses which may attain a large size.

Hitherto, no one had yet recorded that this parasite, if it attached itself (*by way of exception*) to a sprat, could give rise to a pathological manifestation which the writer compares to gangrene. The writer, however, has recently observed such a case in two fish of this species which were caught off the Vendée coast during the winter 1916-1917.

Bacteriology alone will be able to reveal the cause of these singular lesions, that is to say, the organism conveyed to the sprat by the parasite itself.

1200 — The Possibility of Breeding the Walrus (*Trichechus latirostris*) for Meat Production in the United States. — *The Journal of Heredity*, Vol. VIII, No. 8. pp. 339-345, fig. 5. Washington, 1917.

Dr. ALEXANDER GRAHAM BELL made the suggestion (quoted in the article analysed), that it would be a good plan to tame and breed the "Florida manatee" (*Trichechus latirostris*) (1) as a meat-producing animal.

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(1) Two other species "of manatee" are known in addition to the one found in Florida; *Trichechus inunguis*, living on the Atlantic coast from Mexico to 20° south latitude, and *T. Senegalensis* which inhabits the African shores and the Indian Ocean. These three varieties

The walrus has many useful qualities ; it is easily tamed ; eats food which has hitherto not been utilised ; does not occupy land suitable for cultivation ; its meat is excellent, its skin very hard, it supplies a fatty substance, while its bones can be used as a substitute for ivory. When killed, its meat yield is very high : 85 per cent.

The natural food of the "manatee" is "manatee grass" (*Cymodocea manatorum*), an aquatic plant growing in enormous quantities in the rivers of Florida. The stalks of this plant are sometimes 4 ft. long ; it rests during the winter and grows with such luxuriance in summer, that a man with strong rakes can fill a boat with it in 1 or 2 hours. Dr. Carl L. Alsberg, of the Federal Bureau of Chemistry, analysed the plant and obtained the following results :

*Composition of Cymodocea manatorum.*

Water . . . . .	8.7 %
Ash . . . . .	12.9
Ether extract . . . . .	2.1
Protein . . . . .	16.6
Cellulose . . . . .	19.6
Nitrogen-free extract . . . . .	40.0
Ferric oxide . . . . .	2.46

It is probable that *Cymodocea manatorum* would be easily cultivated in the low, warm waters of the rivers, lakes, and marshes of the southern States of the Union ; these waters are at present unproductive.

A law has been passed in Florida for the protection of *Trichechus latirostris*. Amongst other provisions, it inflicts a fine of 500 dollars upon any person who shall hunt these animals, which are still very numerous and easily captured alive, as they are quite harmless.

*T. latirostri* is monogamous in its natural state ; when bred, however, one male can successively serve several females ; the latter produce 1 or 2 young at a birth.

1201 — **Skunk Breeding (1) in the United States.** — *The Journal of Heredity*, Vol. VIII, No. 10, pp. 452-454. 1 fig. Washington, October, 1917.

The skunk has hitherto been regarded as a noxious pest, a destroyer of birds and their eggs and as the agent of frequent depredations on the hen-

are so much alike, that it is difficult to fix the limits of their respective habitats. The only other *Sirenida* besides the walrus is the dugong, or Halicore. The *Dugon dugon* is found in Africa, the Red Sea, Ceylon, India, and the Malay Archipelago. *D. Australis* inhabits the coasts of Australia. The *Dugon* is a more distinctly marine animal than *Trichechus*.

(1) The skunk belongs to the genus *Mephitis* which includes several species ranging from N. to Central America. The fur of the skunk is black and white ; another form belongs to the genus *Conepatus* ; this includes the most southern species. This genus extends to South America, where the animals are very numerous in certain regions (HARMER, S. F. and SHIPLEY, A. E., *The Cambridge Natural History*, Vol. X, p. 439, London 1909). On Rearing Animals for Fur in N. America, see also : *B.* 1911, No. 2854 — *B.* 1914, No. 51 — *R.* 1916, No. 94.

(Ed.)



roost. Now, however, it is being recognised as one of man's valuable allies, not only because it destroys many animals which are injurious to agriculture, but also on account of its increasing value as a fur-producer. More than a dozen of the States have already passed laws protecting the skunk, and probably their example will be followed by other States. Already more than 500 persons are engaged in various parts of the United States in breeding skunks, either selling the skins to furriers or disposing of the live animals to others who wish to start fur farms, which are very remunerative.

Skunks are commercially divided into 2 general classes; the spotted and the striped. The first is small and its skin is not so highly prized. When this pelt is put on the market, it is generally called "civet" (1). The second type of skunk produces a pure black pelt (which is the most valuable) or else skins ranging through the intermediate graduations to pure white. Ordinary raw skins are worth from \$3 to \$6 apiece.

Mr. DETLEFSEN, of the Department of Genetics, University of Illinois, has found a number of mutations which are valuable for their types of fur and he is breeding these and making a study of colour inheritance in the skunk. Some breeders state that they have already been able, by several generations of careful selection, to procure pure black animals which appear to breed true to type.

The principal objection to skunk fur is its strong smell which it is often practically impossible to remove, although gasoline is of value as a deodorant, while chloride of lime works very effectually. The scent is ejected by the animal from two oval sacs situated just below the tail. Most skunk breeders remove these scent glands when the animal is quite young by means of a simple operation. One breeder, however, declares that when skunks are reared in captivity and treated with kindness, they no longer throw their scent and therefore any operation is unnecessary. Skunks are easily tamed. The females breed once a year, generally in the early spring. They have 6 to 12 young in a litter. The animal is adult at 6 months old.

## FARM ENGINEERING.

AGRICULTURAL  
MACHINERY  
AND  
IMPLEMENTS

1202 — **Electric Ploughing.** — DELAMARRE, A., in *Revue Générale de l'Electricité*, Vol. I, No. 18, pp. 691-700, figs. 14. Paris, May 5, 1917.

Of late years great progress has been made in the use of tractors for cultivation, a statement which does not apply equally well to the use of electricity. The writer considers previous efforts in this direction, with the methods used to resolve the problem of electric ploughing. In discussing the power required for traction, the writer shows that 60 H. P. should be available for hauling. In practice the motors for electric windlasses vary

(1) This name properly belongs to some African *Viverridae*. (*Viverra civetta*) and to the Asiatic forms *V. indica* and *V. gracilis* or "Lisang". Cf. BREHM, *Merveilles de la nature, Les Mammifères*, Vol. I, pp. 548-556. Paris, Baillière. (Ed.)



from 90 or 100 H.P. With a 60 H.P. windlass 8.64 acres can be ploughed in 12 hours, while with a 90 to 100 H. P. windlass as much as 12 or 15 acres may be ploughed. But there is a limit to the use of more powerful windlasses on account of the weight, and efforts should be directed towards using material as light as possible.

Tractors and windlasses represent the two systems employed for hauling ploughs. Tractors and motorploughs seem, generally speaking, to be more suitable for breaking up stubble, ordinary ploughing (6 to 7 ins.), harrowing, etc., rather than for deep ploughing, for which windlasses are usually preferred.

As an electric tractor should be mentioned, if only as a record, the ZIMMERMAN system, from Halle-sur-Saale (Germany).

The balance plough received current from a strongly insulated cable supported at distances of about 130 feet apart. Its distinctive feature was that it hauled itself along a chain fixed at each end of the field. At each headland, after tipping the plough, the current was reversed by means of a commutator, thus changing the direction of the plough. The chain, weighing about 500 to 600 grammes per metre, was moored at each end by a light anchor weighing only 77 to 88 lbs. and which could easily be moved by one man with a lever. The coefficient of utilisation of the plough was over 50 % and only required some 15 to 20 H. P.; its price, including 812 feet of towing-chain, 2 anchors, 6 waggons, and 1950 feet of electric cable, varied from £ 360 to £ 600 according to the power, while the FOWLER steam-capstan cost from 5 to 10 times, as much. The cost of deep ploughing 53 ins. deep, with the kilowatt-hour costing 1.8 d., was 8s. per acre. It was introduced into France by M. MAGNIN DE CHARMES with several improvements concerning the method of supplying the current. In spite of its good qualities the ZIMMERMAN plough was not successful. The writer thinks that the idea, however, is worth taking up again.

Electric capstans have been brought to a high state of development by various firms, such as: ECKERT; SIEMENS; A. E. G. (Germany); SOCIÉTÉ ELECTROTECHNIQUE of Turin; MARELLI (Italy); FILLET; SOCIÉTÉ DE CONSTRUCTIONS DU NORD ET DE L'EST at Jeumont, (France). If electrical ploughing is not practised more commonly in France, it is due to lack of co-operation between manufacturers and central stations and lack of technical and financial enterprise in agricultural circles. The FILLET and SIEMENS haulages have proved their merits, and now, good results are expected from one made shortly before the war by the SOCIÉTÉ DE CONSTRUCTIONS DU NORD ET DE L'EST.

The SIEMENS gear is chiefly used in Germany and Spain. There are two types, one designed to work alone with an anchor wagon at the other end of the field, and one designed to work in pairs. This capstan consists of a solid metal frame on which is mounted: 1) a 60 to 90 H. P. electric motor; 2) an ordinary capstan whose drum or drums can accommodate 1200 to 1500 feet of steel cable and which gives two speeds forward of 43 and 63 inches per second; 3) gearing which can either be coupled up to the windlass or to the rear-wheels, so as to propel the truck and, if necessary, to turn in a very small radius with the plough clear. The tractive effort is 8800 lbs. The motor is coupled to the windlass by means of a completely enclosed belt which acts as a shock-absorber when the plough fouls large stones, roots, etc.; this device allows the motor to be used for driving threshers, etc. The anchor-wagon used with the double-windlass car, weighs 4 metric tons, and its wheels are fitted with thin discs to increase the hold. The objection to the SIEMENS windlass car is its great weight, 13 tons, which renders transport very difficult.

The 45 H.P. FILLET windlass weighs 8800 lbs., while the 60-80 H.P. type weighs 13200 lbs.; its tractive effort of 8800 lbs is equal to that of the SIEMENS windlass, which weighs 3 times as much. The electric motor is geared up directly to the windlass and also moves

the wagon forward, either by means of a chain drive or by hauling on a cable fixed some 650 feet away. The whole is mounted on a steel frame.

The windlass-car is provided with an anchor-spade consisting of a thick metal plate as long as the truck, driven in to the ground and permitting of a side pull of 57 200 lbs., *i.e.*, 6  $\frac{1}{2}$  times the weight of the machine itself. Tipping is thus rendered impossible. The JEUMONT windlass, with an 80 H.P. motor, weighs 13 tons and gives a pull of 8 800 lbs. It may be classed with the SIEMENS type.

The Author favours the light type of machine. Great weight is not required to prevent tipping; rational anchoring gives perfectly satisfactory results. It suffices that to resist the pull of the cable the anchorage should have a supporting surface at least equivalent to the sectional area ploughed; the anchorage resistance is equal to that of the plough; the weight of the capstan, etc., give additional security. The FILLET anchor-plate offers 1 sq. m. of resistance surface, *i.e.*, 3 times that of the area of the section. Everything is in favour of the lighter equipment, which improves considerably the prospects of electric ploughing.

One of the principal reasons why electric ploughing has not been practised more extensively is the problem of obtaining current supply. A 60- or 80 - H.P. motor can hardly be fed economically, even for short distances, at less than 500 to 600 volts; this pressure is quite high enough for the safety of farm work people, but high-tension distribution is needed from part to part of the farm. The usual arrangement is to run high-tension overhead lines for distribution purposes and to tap off from them through a portable transformer truck. It is not a simple matter to make jockey connections to overhead lines and carry wires thence to the transformer car without risking short-circuits or fatal shocks. A better system is to use an aerial switch so arranged that contact with the line cannot be made or open unless the interrupter is open. This arrangement is more expensive, but the workpeople are safe, at any rate. The windlass may be 700 to 800 metres from the transformer, so that a smaller number of distributing centres is required. The SIEMENS portable transformer is mounted in a double-ended wagon with two compartments containing respectively the transformer with its cut-outs, low-tension fuses, meter, cable drum, etc. Instead of wearing out the cable by trailing it along the ground, it is carried on insulators supported by a rod or on two tubes crossed in X shape.

The cost price per acre (1) is calculated by the writer as follows:

Land can be ploughed 12 ins. deep at the rate of 10 acres a day with a consumption of 32 kw.-hrs. per acre. Three men (one an electrician) and a boy can operate a ploughing set, the total wages being calculated at 16s a day. The author allows (per acre) 1s. 7.2d. for labour, 4s. 9.6d. for current (at 1.9d. per unit, and with an allowance for oil, propelling the windlass, etc.), and 13s. 9.12d for fixed charges: total = 20s. 1.92d per acre. To these working expenses should be added interest on capital and depreciation.

The capital cost of 2 windlasses, plough, 2 km. of cable and the transformer, is about £2000; that of 10 to 15 km. of distributing line up to 6000 volts for a 865 acre farm is about £1600; and of the transformer connecting up to the overland transmission system, about £240, making a total of about £ 4000 (a sum, which, at present prices, should be doubled).

Allowing £ 600 for interest, the up keep and depreciation reserve are estimated respectively at 5 % of the capital and there would be a fixed charge per acre of 600 : 865 = about 14s.

(1) Only pre-war prices are indicated.



The larger the farm the less would be the cost of electric ploughing; for a 1205-acre farm, it is reduced to 15s. 8d. Steam ploughing, on the other hand, in the Soissons (France) region, costs about 24s. per acre, not including coal and water to be provided by the farmer.

If the windlass is used for harrowing, rolling, etc., the cost decreases to about 12s. per acre for a 740-to 865-acre farm, giving a saving of 50 % over the cost of steam ploughing. Tractor ploughing costs 24s. per acre at 7 to 8 in. deep, which is equivalent to 30s. 5d for ploughing 11 in. deep.

**1203 - The Choice of the Type of Agricultural Tractor Suited to French Conditions. —**

DE. PONCINS, A., in *La Vie Agricole et Rurale*, Year 7, No. 40, pp. 237-244. Paris, October 6, 1917.

According to the writer, a tractor that is well suited to the conditions of French agriculture should satisfy the following essential conditions :

1) Should be able to work in the heaviest clays, even when wet, slippery, and sticky. The Americans have neglected this question because their soils are usually dry.

2) Should be able to pass again over freshly ploughed land, without causing packing or caking.

3) Should be able to turn in a small radius.

It would be preferable, but not indispensable, that it could either pivot round or set off in the opposite direction without turning round, so as to come back on the same furrow when using a balance or turn-wrest plough.

4) Should be available for carting, either on the road or on any ground for farmyard manure. Tractors with one large driving-wheel are unsuitable for the road and it is their greatest disadvantage against certain important advantages.

5) Should be able to drive the fixed farm-machinery, such as threshers, mills, pumps, etc.

6) The width between the wheels should be sufficiently narrow (59 ins.) to allow it to pass on rural bridges and roads, and so that the ridge can be finished without passing over previous work.

All these conditions are by no means incompatible. The power required depends on the size of the farm, but a certain minimum may be fixed below which mechanical traction loses its advantages (save a few exceptions). This will be seen from the following considerations regarding : 1) the labour; 2) the work ; 3) the possibility of finishing the first furrows with the tractor.

**LABOUR.** — The chief advantage of mechanical traction is economy of labour. Theoretically, only one man is necessary to drive a tractor towing an automatically-lifting plough. In practice, two are required, one to drive and one as assistant. A tractor towing a single plough 7 to 8 ins. deep in heavy soil and travelling 3 000 yards per hr, can barely plough 2.5 acres per day, which is equal to the work of 3 teams of 3 good horses each. With a single-furrow plough there is no saving, but economy commences when 2-furrow ploughs are used and is only appreciable with 3-furrow ploughs, becoming important with 4 or 5. The writer considers the latter number sufficient, so as to avoid locking up too much capital and using too heavy a weight.

**WORK.** — Work carried out more quickly in suitable weather. It is indispensable that a tractor should do the greatest possible amount of work in a day ; therefore sufficient power should be provided for towing 3 or 5-furrow ploughs at the rate of 3 000 yards per hour.

**POSSIBILITY OF FINISHING THE RIDGE WITH THE TRACTOR ITSELF.** — To do this the tractor requires sufficient power so as to turn over a width of ground equal at least to the distance between the wheels, *i. e.*, of at least 71 inches. Now, a tractor with 2 driving-wheels, towing a 2-furrow plough, is obliged to leave a series of unploughed bands of from 3 ft. 3 in. to 4 ft.



every 130 to 162 yards, which have to be finished by a team. The tractor, therefore, should be sufficiently powerful so as to tow at least a 4-furrow plough (width of work, 4 feet) or still better a 5-furrow one. Nevertheless this disadvantage is obviated by using ploughs turning the soil alternately to left and right; or at any rate the difficulty would only occur once when finishing the headland.

After considering the power required for a tractor towing either a 3-4-, or 5-furrow plough in any kind of soil, the author concludes that the 8-16 H. P. tractors are much too feeble and give little advantage over animal traction. The 10-20 H.P. type is the minimum, being only suitable to easily-worked soils. For stiff soils, the 16-32 H. P. type is required, allowing for a speed of 2517 yds. per hour; for a speed of 3500 yards per hour, at least the 25-50 H. P. type is required if more than 50 % efficiency is to be obtained (windlass or towing).

Considering the methods employed for connecting plough to tractor, the writer thinks that the present preference given to tractors independent from the plough will be in future given to tractors carried on 3 or 4 wheels with the plough bodies fixed underneath the motor chassis itself or to 2 wheel motors in front combined with the plough in the rear.

Tractors on 3 or 4 wheels and carrying the plough bodies fixed under the chassis, appear to have some theoretical advantages: reduction in length of chassis; easy lifting or engaging the shares by using the power of the motor; less labour required of a less tiring nature; economy of metal, giving reduced cost price. Of this type is the motor plough by PAVESI and TOLOTTI (1) of Milan, Italy, as well as the 4 American machines: Lawter One Man Tractor; "Brillion"; Hackney Auto-plough; Albany-Dover Square Turn. While agreeing that this type is worth the attention of makers, the writer asks whether it would not be better to adopt an intermediate condition by placing the plough not below the chassis but just behind, as in the French "Amiot" and the Swedish "Avance" motorploughs.

With the types with front driving-wheels as the Moline (2) and the English "Fowler Plough" and "Crawley-Agrimotor" (3), the advantage lies in utilising the whole length of the chassis to grip the soil. This system is suitable for low-powered 2-furrow-machines at the most, a type particularly adapted for vineyards. Martin's Motorplough, another English machine, has 4 front driving-wheels, of which two on each side are coupled on the chain-track system, this giving greater grip and increased power. It only weighs 2 200 lbs and is of 16 H. P. This machine has not yet been tested in practice.

The grip on the soil is the greatest difficulty confronting mechanical traction. From this point of view, the windlass and towing tractors seem to solve the problem most satisfactorily. Chaintrack tractors offer a large surface, so that a heavy weight can pass over soft ground without packing it too much. As yet, sufficient evidence is not available to allow of judging the caterpillar tractors from the economic point of view.

Considering tractors from the standpoint of the number of driving-wheels, the writer thinks that the tractor with 4 driving-wheels, not yet satisfactorily worked out, would be the best, if it could be realised without too much complication. The total weight would be distributed over the 4 driving-wheels; the 2 wheels on the right would run in the furrow, the 2

(1) See *B.*, 1912, No. 550 and *B.*, 1914, No. 557. (2) See *R.*, October 1917, No. 941.

(3) See *R.*, October 1917, No. 942. (Ed.)

on the left on the unploughed land ; each one would not be overweighted and furrow-packing would be much diminished. To avoid turning, the machine should be able to reverse its direction and might tow a balance plough or, better still, be fitted with left and right hand bodies that could be raised or lowered alternately. There would be better grip, the power would be used more effectively, and skidding would be decreased.

After calling attention to the disadvantages of solid treads furnished with grips, the writer notes the advantages of the webbed-tread, applied (as far as he is aware) only to an American machine. By webbed-tread the writer refers to a large wheel whose tread is formed by narrow rims joined by cross members. The cross members, being on the level of the lateral rims, travel quite well on the road, the narrow rims acting similarly to carriage wheels. The idea of driving wheels with retractable strakes, as made by some manufacturers, would be satisfactory if their strength was perfectly certain.

Finally, the writer considers the quality of the material and methods of construction requisite for giving lasting qualities to tractors, as well as gear-protection, lubrication, etc., and to avoid repairs and readjustments.

1204 - **Attachment for Adapting a Motorear to Agricultural Traction** (1). — *Scientific American*, Vol. CXVII, No. 11, pp. 196, 1 fig. New York, September 15, 1917.

This device permits of adapting a motorear to tractor work with but little trouble, by a special reduction gearing carried independently of the automobile chassis. The device can be attached in 10 minutes and removed in half the time.

The usual road speed of 40 miles an hour is reduced to a farming speed of about 2 miles per hour by the reduction gearing. An engine speed of 1000 revolutions per minute will permit the converted machine to do the work of 3 or 4 horses. The machine is designed on practical mechanical lines, all frame members being of angle steel. The wheels are built up of rolled steel rims and steel spokes and have cleats riveted to the rim to provide a grip.

The wheels turn on large anti-friction bearings. An extra watertank should be provided to prevent the engine from overheating during work.

The accompanying figure shows the method of installation. The view at *A* shows the device in such position as to permit backing the car between the 2 sections. At *B* the car is shown in place between the sections and forward members of the attachment, with the latter ready to be pushed under the car. The view at *C* shows the attachment in place.

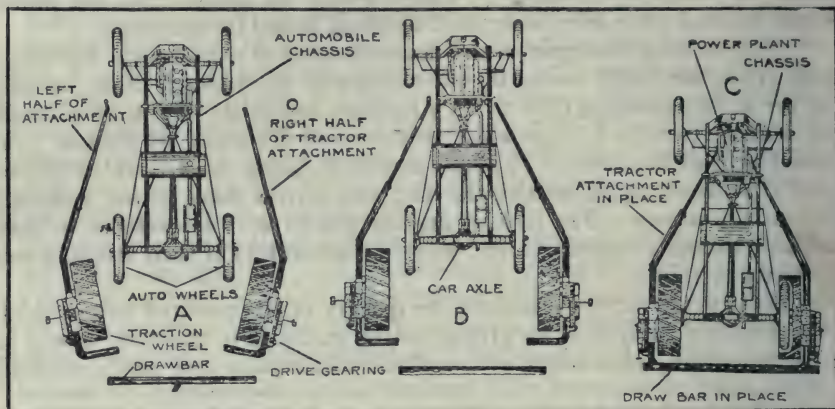
The construction is such that the wheel hub, provided with special driving lugs, fits into the recess in the hub of the attachment. When in place, the members are firmly secured. The front ends of each section are bolted together and then attached to the front axle by a U bolt fitting. The power from the wheel hubs passes through a train of reduction gears

(1) See also *R.*, June 1917, No. 577. (Ed.)



on each section and the traction wheel speed is greatly reduced as compared to the auto wheel speed.

This attachment can be used for a wide range of work now done by horses, such as ploughing, disking, harrowing, seeding, hauling, etc.



Method for adapting a motor-car to tractor work.

1205 - **Rick Drying by Machinery.** — *The Implement and Machinery Review*, Vol. 43, No. 510, p. 608, fig. 1. London, October 1, 1917.

Mr. J. E. NEWMAN uses, on his farm at Pershore, a centrifugal blowing fan for drying his ricks.

The 6-in. centrifugal blowing fan was driven by a 2 h. p. petrol engine and blew air through a wooden pipe made of planks 6 in wide and 16 ft. long, into the centre of the ricks which were built on 8 yd. by 5 yd. staddles.



Rick drier in position.

The pipe was built into the rick on the slant, so that the end of the pipe discharged air into the centre. The accompanying figure shows the installation of the device.

Ten ricks were so treated and when threshed the wheat was found to be hard and dry, in better condition than that from ricks erected afterwards in better conditions. Three of the ricks were put up with the clover — which was tall and in bloom when the wheat was cut. — still quite damp.

The ricks did not heat, and when threshed out in the middle of November the corn was dry, and the straw sweet and clean.



One rick was found to be at a temperature of 74°F, and, after half an hour's blowing, the temperature was found to be 56°F, the same as the air temperature.

If the rick to be dried is a large one, it would be possible, by providing a number of outlets to the wooden chute, to deliver the air to different parts of the rick simultaneously, instead of blowing it all to the centre.

1206 — **Electricity Applied to the Threshing and Drying of Cereals, in Italy.** — TARCHETTI, A., in *Il Giornale di Riscultura*, Year 7, No. 18, pp. 229-234. Vercelli, September 30, 1917.

**THRESHING.** — The wide use of electric threshers shows that the problem has been solved both economically and mechanically.

For threshing carried out in the farm or its immediate neighbourhood, and where a low-tension electric current is available, the steam plant has only to be replaced by the electric motor to obtain secure and regular working with an assured economy of more than 50 % of the previous expenses.

For portable threshers, the electric motor with accessories can be mounted on a waggon, the thresher being driven by means of a belt; or else the motor might be fixed directly on the thresher, being mounted on a bracket which is usually placed in the rear.

With the first system, a better yield is obtained from the belt, but time is lost in placing the waggon in position.

The second system requires protected motors and a very light belt; less space is occupied by the thresher, and the machine is more easily moved.

For ploughing, continuous current motors are preferable, and for threshing three-phase motors of constant speed, which is essential for good screening and winnowing.

The current required for ordinary portable threshers is, on an average, as follows:

for a 24 inch thresher . . . . .	4 kw
» » 30 » » . . . . .	6 »
» » 36 » » . . . . .	8 »
» » 42 » » . . . . .	10 »
» » 48 » » . . . . .	13 »

**ARTIFICIAL DRYING AND HEATING OF THE AIR.** — Dryers are now much in use, but they still have certain disadvantages which might be eliminated by using electric heaters placed at various points in the air current. Not only do they provide for a constant temperature, but they allow of increasing or diminishing the heat in the various parts of the drier. With electric heating, the bad smell due to the products of combustion is eliminated. Moreover, it occupies little space, is easily cleaned and requires much less attention than does heating with wood or charcoal (1).

At first sight, comparison between electric and ordinary heating, appears disastrous for the former; theoretically, 1 kg. of coke produces 7000 calories, while 1 kw. barely produces 846.

(1) Electric heating might well be installed in silkworm nurseries to keep up a constant temperature in the incubation and rearing rooms. (Author)

Assuming the ordinary price of coke to be 5 fr. a quintal, the kilowatt would have to cost not more than 0.5 centimes to yield, at the same cost, the same heating power.

It is, however, different in practice, for more than half of the 7000 theoretical calories of the coke is lost by bad furnaces, radiation, etc., while the heat of the electric heater (which may yield 100 % if it is a good one), is completely utilised in the drying room. Nevertheless, even admitting that 1 kg. of coke yields 3000 calories in practice, it would be necessary, in order to equalise the cost, to pay a maximum of 1.5 centimes per k.w., which would not be accepted by any electric-supply company.

Under the present circumstances, the problem shows much more favourably for electric heating, on account of the high prices of fuels.

This condition may continue for some time after the war, but it is evident that the agriculturist cannot afford to pay the present prices for electrical energy for heating the dryer. However, if he could obtain the current required for the farm at contract prices, the electrical heating of the dryer (1) would furnish an excellent method for consuming all the current provided for in the contract, provided always the current contracted for was more than the farm actually required.

1207 - **The "Metrolac" Apparatus for Recording the Amount of Dry Rubber in Latex.** — *The Queensland Agricultural Journal*, Vol. VII, Part. I. pp. 26-27. Brisbane, 1917.

For the information of rubber planters, the Rubber Growers' Association (London) has published an account of an instrument, the "Metrolac", of which the sole manufacturers are MESSRS DRING & FAGE (London).

The "Metrolac" records the amount of dry rubber in latex, and thus enables a check to be kept on the amount of water added.

The amount of dry rubber in latex to which water has not been added, will vary with methods of tapping, etc., from 3 to 5 lb. per gallon.

This instrument would be particularly useful in controlling latex collected by the natives, as regards any fraudulent, or excessive, addition of water. By means of the "Metrolac", the latex can, after "bulking", be watered down to a standard rubber content, so that in sheet-making all the sheets are of uniform size and thickness and are generally uniform. The amount of acid necessary for coagulation can also be determined, for it depends upon the quantity of rubber in the latex which is rapidly ascertained by the rise of the "Metrolac". The latter is also of practical application when paying coolies by results.

The "Metrolac" is of brass gilt and measures about 10 in. long. It is supplied complete with measuring glass (graduated in pounds and ounces per gallon) for testing. When paying the coolies, it is necessary to measure the latex in units smaller than the gallon; the unit suggested is the half-

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(1) Considering the amount of heat required for cereals in bulk, in order to evaporate the water and to compensate for losses from the dryer, it may be taken that about 6 000 to 11 000 calories are required, that is, 7 to 12 k.w. per quintal of dried material. As thorough drying requires at least 2 hours, each quintal of cereals placed in the drier requires of from 3.5 to 6 kilowatts.

(Author).



pint. The calculation is quite simple, for as there are 16 oz. to the pound, and 16 half-pints. to the gallon, the instrument will correspond to the ounces to the half-pint as well as to pounds to the gallon.

By means of the "Metrolac", a check may be kept on the amount of rubber obtained and when this tends to fall in trees that are tapped too severely, or are overstrained, the field may, if necessary be, rested.

This instrument can also be used to forecast the daily output of dry rubber on an estate.

**1208 - The Milking Machine in British India.** — JOHN, H. ST., in *The Journal of Dairying and Dairy Farming in India*, Vol. III, Part IV, July, 1916; reproduced in *The Agricultural Journal of India*, Vol. XII, Part. II, pp. 291-294. Calcutta, April, 1917.

Several periodicals of British India have recently considered the possibility of introducing the milking machine into India.

According to English and American reports on trials with the milking machine, it appears that, during the last 2 or 3 years, its construction has been much improved. The writer considers the general conditions appertaining to its use and thinks that it will sooner or later be introduced into India owing to shortage of labour.

Good milkers are every year becoming more difficult to find. The "gowalla" of former days, milkmen from father to son, are uncommon now. The younger generations seek other occupations in the large towns of the Empire. It thus become more and more necessary, in large dairies, to train milkers, and it will probably be necessary to replace hand milking by machine milking.

To be successful, the milking machine should be introduced gradually, at first only using it for a few cows at a time and only gradually extending its use in measure as it becomes well known. It would be a mistake to introduce it on a large scale now. Trials with the milking machine will, before long, be carried out in India and a report on the work of the machine milker on native cows and under actual Indian conditions will be published later.

**1209 - Apparatus for Determining the Water Content of Cheese.** — I. TROY, H. C., in *Hoard's Dairyman*, Vol. LIV, No. 1, p. 4, fig. 2. Fort Atkinson, Wisconsin, July 27, 1917. — II. *The Journal of Agriculture*, Vol. XXI, No. 3, pp. 41, fig. 2. Quebec, Canada, September 15, 1917.

Laws have recently been enacted limiting the amount of water in Cheddar cheese. As the ordinary butter moisture test cannot be used for estimating the water content of cheese, the writer devised a very simple drying apparatus about 5 years ago, to be used in determining the water content of cheese. It consists of a doublewalled copper cup containing melted fat, or oil, between the walls. The temperature of the cup is controlled by inserting a thermometer in the oil and then heating the apparatus to the desired point with a small spirit lamp. The outer jacket of the cup which holds the oil is 4 1/2 inches wide, and the same in height. It has a flat bottom and perpendicular walls. The inner cup must have a flat bottom; it is 2 3/4 inches in diameter and 3 3/4 inches deep. A flange at its upper rim extends out at right angles to the cup wall and forms a



cover for the space between the walls of the outer jacket and the cup when in place. The flange is bent down around its outer edge to make it fit snugly over the upper rim of the outer jacket; it thus holds the inner cup securely in its place, leaving a space for the oil between the walls and bottom of the apparatus. A circular opening of about  $\frac{1}{2}$  in. in diameter is made through the flange to permit the insertion of a thermometer. An ordinary flat bottom Erlenmeyer flask placed in the oil bath cup may be used to hold the cheese during the drying operation, but a long-necked flask is better. A flat metal cover is placed on the cup when making the test, in order to keep the body of the flask at a constant temperature. The cover has a hole in the centre just large enough to permit of the neck of the flask extending up through it. In order to heat it, the apparatus is placed on a tripod over a spirit lamp.

The flask should have perpendicular walls and its height should be  $4\frac{3}{4}$  in. including the neck, which is 1 in. in diameter. The flask must fit well into the cup of the drying apparatus. The copper drying cup can be made by any tinsmith.

Lard or tallow serves best between the cup walls. Readily inflammable oils should be avoided.

*Operating the test.* — First light the spirit lamp in order to warm the oil, or fat, bath while the test sample is under preparation. A representative sample of the cheese may be secured with a cheese-trie and kept in a glass stoppered sample jar. It is then cut into pieces about the size of wheat kernels, and 5 grams of it are accurately weighed into the clean, dry flask. When the oil, or fat, has reached the temperature of between  $284^{\circ}$  to  $293^{\circ}$  F. ( $140^{\circ}$ - $145^{\circ}$  C.), as registered by the thermometer, the flask is placed in the cup of the oil bath and covered with a flat disc-shaped cover having a central aperture through which passes the neck of the flask.

The flask is allowed to remain in the bath 50 minutes, the temperature being maintained between  $140^{\circ}$  and  $145^{\circ}$  C. all the time. Then the flask is removed, and allowed to cool. It is subsequently weighed and from the difference in weight is estimated the amount of water removed by drying.

**1210 — Apparatus for Selecting Cocoons in Silkworm Rearing.** — *Le Génie Civil*, Vol. LXXI, No. 14, pp. 235-236. Paris, October 6, 1917.

In 1916 the Sericultural Association of Japan opened a competition for the best apparatus for distinguishing male and female cocoons. Of the twenty-seven apparatuses entered, four were awarded prizes, those of Messrs. AOKI, MATAKEYAMA, OSAWA and TOMITA.

The action of these four apparatuses is based on the fact that the male cocoon is lighter than the female cocoon, but it seems impossible to distinguish with certainty the sex of the chrysalis without opening the cocoon, i. e. by destroying it.

Mr. AOKI's apparatus, which gained the first prize, is exceedingly simple. It consists of a lever, the two arms of which are in the proportion of 1: 15. At the end of the small arm is a basket into which are placed 15 cocoons chosen at random, and which, consequently, represent an average weight between that of 15 male cocoons and 15 female cocoons. At the end of the

long arm is a hinged platform, on which are placed successively, one by one, the cocoons tested. The lever is balanced when empty by means of a sliding weight. According to whether the long arm of the lever falls or rises, the platform sways to the left or to the right, dropping the cocoon into one of two compartments. If the lever remains equally balanced, i. e., if the cocoon is of average weight, and, consequently, undetermined, it is sufficient to press a button placed on a support crossed by the long arm of the lever, to make the platform sway forward and drop the cocoon into a compartment corresponding to a third class.

The other three prize apparatuses are much less simple, but all allow a classification satisfying practical requirements.

## 1211 - Review of Patents.

### *Tillage Machines and Implements.*

Canada	177 722. Stubble burner.
Denmark	22 403 — 22 428. Motorploughs.
United States	1 237 407 — 1 239 090. Wheeled ploughs.
	1 237 505 — 1 237 626. Gang-ploughs.
	1 237 556. Harrow.
	1 237 610. Stubble plough.
	1 237 825 — 1 239 281. Ploughs.
	1 237 947. Agricultural implement.
	1 238 057. Sulky plough.
	1 238 252. Disc plough sharpener.
	1 238 821 — 1 238 953. Cultivators.
	1 238 969. Light tractor gang-plough.
	1 238 998. Disc cultivator attachment.
	1 239 091. Disc-harrow.

### *Manure Distributors.*

Denmark	22 438. Manure distributor.
United States	1 237 629. Fertilizer dropper.
	1 238 170. Fertilizer distributor.

### *Drills and Seeding Machines.*

United States	1 238 157 — 1 238 158. Clutch mechanism for maize planters.
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### *Various Cultural Operations.*

Canada	177 412. Plant protector.
United States	1 237 804. Cotton-chopper.
	1 237 854. Cultivator (for maize).

### *Control of Diseases and Pests of Plants.*

United Kingdom	108 746. Animal traps.
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### *Reapers, Mowers and Harvesting Machines.*

Canada	177 555. Binder reel.
Italy	157 799. Motor mowing machine.
	158 295. Universal mower for hay, fodder plants, cereals, etc.
Switzerland	76 162. Hand mowing machine.
United States	1 237 543. Rake and loader.
	1 237 661 — 1 237 689 — 1 237 690. Mowing machines.
	1 237 695. Grain-binder.

- I 237 832 — I 238 047. Cotton boll harvesters.  
 I 237 859. Cane harvester.  
 I 238 402. Maize harvester.  
 I 239 153. Combined side delivery rake, tedder and swath-turner.  
 I 239 353. Green maize cutter.

*Machines for Lifting Root Crops.*

- Canada I 77 403. Root puller.  
 I 77 792. Harvester for roots.  
 United Kingdom I 08 890. Potato-digger.  
 United States I 239 337. Beet harvester.  
 I 239 354. Potato-digger.

*Threshing and Winnowing Machines.*

- Canada I 77 440 — I 77 645. Threshing machines.  
 I 77 583. Vetch separator.  
 United States I 237 896. Wind regulator for grain separators.  
 I 238 970. Automatic shock-threshing machine.

*Machines and Implements for the Preparation and Storage of Grain, Fodder, etc.*

- Switzerland 76 163. Installation for the preparation and storage of maize silage.  
 United Kingdom I 08 557. Elevator for hay loader.  
 I 08 774. Baling press.  
 United States I 237 305. Hay-loader.  
 I 237 495. Baling press.  
 I 237 916. Ensilage packer.  
 I 237 971. Fruit box press.  
 I 238 893. Power potato cutter.  
 I 239 216. Grain drier.

*Forestry.*

- Canada I 77 538. Stump puller.

*Steering and Traction of Agricultural Machinery.*

- Italy I 52 582. Automatic anchor-waggon by NANNI and MELANDRI for mechanical cultivation.  
 I 58 299. Tractor for towing ploughs, harvesters, waggons, etc., to replace oxen.  
 United Kingdom I 08 584. Steering mechanism for agricultural tractor.  
 I 08 833. Motortractor.  
 United States I 237 814. Tractor tread link.  
 I 237 939. Farm tractor.  
 I 238 702 — I 238 752. Tractors.  
 I 238 732. Traction engine.  
 I 238 762. Attachable tractor for automobiles.  
 I 239 147. Draft equalizer.  
 I 239 328. Tractor engine.

*Feeding and Housing of Livestock.*

- Canada I 77 729. Feed box for horses.  
 Italy I 58 445. Utilisation of palm nuts and seeds for feeding of livestock.  
 United States I 237 606 — I 237 784 — I 238 093 — I 238 900. Hog oilers.  
 I 238 212. Hog feeding device.

*Aviculture.*

- Canada I 77 577. Feather picking machine.



United Kingdom 108 932. Means enabling fowls to open the door of the poultry house.  
 United States 1 237 345. Egg-carrier.

*Apiculture.*

United States 1 237 741. Honey section.

*Industries Depending on Plant Products.*

Brazil 9 724. Drier for preparing raisins.  
 9 782. New apparatus for improving alcoholised wines.  
 United States 1 237 528. Fruit-pitter.  
 1 237 623. Process of peeling peaches or other fruits or vegetables.  
 1 237 708. Rice-popping machine.  
 1 237 874. Drier for alimentary paste.

*Industries Depending on Animal Products.*

Switzerland 76 099. Process for utilising slaughter house offals.

*Dairying.*

Canada 177 694. Churn mechanism.  
 177 821. Milk bottle holder.  
 Denmark 22 358. Cover for milk can.  
 Switzerland 76 051. Device for holding a cow's tail during the milking.  
 76 091. Churn device.  
 United Kingdom 108 876. Press for cheese, etc.  
 United States 1 237 363. Cream box.

*Farm Buildings, etc.*

Canada 177 419. Wire stretcher.  
 United States 1 237 731. Sliding door.  
 1 237 774. Form for constructing concrete silos.  
 1 237 835 — 1 237 881. Gates.

*Various.*

Canada 177 695. Oil can.

**1212 — The Construction of Pit Silos (1) in the United States.** — PRYSE, METCALFE, T. and SCOTT, GEORGE, A., in *United States Department of Agriculture, Farmers' Bulletin* No. 825, pp. 14, figs. 6. Washington, 1917.

FARM  
BUILDINGS

Pit silos are becoming common in many sections of the Great Plains region of the United States, where wooden silos weaken rapidly owing to the peculiar weather conditions obtaining there. The farmer with the help of his ordinary farm hands can construct a pit silo fairly cheaply.

The site chosen should be in firm, well drained soil. The cylindrical type is the one usually chosen. The depth of the silo depends on the quantity of silage to be stored, but rarely exceeds 36 feet. The walls are plastered about one inch thick with mortar made of one part cement and 2 or 2 ½ parts of clean, sharp sand. The bottom is left bare. A concrete curb is made before digging the pit, a 4 ft. wall being afterwards built on it; concrete, brick, tile blocks, etc., may be used. A hoisting apparatus is mounted over the silo to provide for easy and rapid removal of the silage.

(1) See B., 1911, No 3225; B., 1912, No. 391; R., 1916, Nos. 333 and 435; R., March 1917, No. 284. (Ed)

The bulletin summarised describes the construction of these silos, the method of digging out the soil, the choice of site; it indicates the dimensions, (2 tables) and gives details regarding filling, removing the silage for feeding cautions against poisonous gases in the silo and the construction of a cover. A number of figures clearly illustrate the information given. At the end of the bulletin a list is given of all the bulletins previously published by the U. S. Department of Agriculture with regard to silage and the construction of silos.

## RURAL ECONOMICS.

**1213 - The Method of Valuation of Real Estate ; Part II: Its Application to Agricultural and Forest Valuations.** — SERPIERI, ARRIGO, in *Estratto degli Annali del R. Istituto Superiore forestale nazionale* (Vols. I and II), pp. 52-196. Florence, 1917

The first part of this work on the methods of valuation of real estate was summarised in the January, 1917 number of this *Review* (No. 83). The second part, which deals with the application of the methods previously studied to agricultural and forest valuations, forms the object of the present bibliographical note.

Chapter III, the first of the 2nd part, is a discussion, raised by AEREBOE's treatise on valuation, on the question of the substitution of the synthetic for the analytic method of valuation. Paragraph 18 shows the usefulness of the analytic method for valuations whose aim is other than a knowledge of market prices. The following paragraphs are devoted to this latter end: paragraphs 19-23 examine the difficulties of the application of the analytic method, the possibility and means of overcoming them. Special mention must be made of paragraph 20, which deals with the *statistical* determination of the rate of capitalisation, and paragraphs 22-23, which discuss the application of the analytic determination of farm profits to estimate the means of production *without the market prices*, and how to choose between the different technical methods of cultivation.

Paragraph 24 sets out the difficulties of applying the synthetic method and the appendix discusses particularly this method as proposed by AEREBOE. The conclusion is contained in paragraph 25, which shows that, in the estimation of market prices, both the synthetic and analytic method have a field of application peculiar to themselves, for which the modalities are specified.

Paragraph 26 shows that the estimation of market prices (by whatever method) always presumes statistical research into the effective buying and selling prices of real estate.

In chapter IV are discussed the most controversial points in forest valuation. In paragraphs 29-30 are condensed to a small number of types the numerous and varied formulae given by various authors for the capitalisation of forest revenues. Paragraphs 31-32 solve two of the most disputed points: 1) whether, as many authors maintain, the capitalisation of revenues from forest land should be lower than that from agricultural land; 2) whe-

ther this capitalisation should be based on the corresponding cycles of financial management ( "turno finanziario ") (1):

Paragraphs 35-36 are devoted to the estimation of the market price of woods; they show the difficulties essentially inherent to the slight mobility of such real estate, and the resulting impossibility of useful statistical research into the prices. An estimation of the probable market prices may even be impossible, but there always remains the possibility, by the capitalisation of the revenues, of judging the relative advisability of investing savings in buying a specified wood.

Among the other paragraphs, in which the numerous valuation methods proposed by various authors are closely examined and criticised, the last two, dealing with the difficult problem of the valuation of selection forest ("fustaie da dirado") must be mentioned particularly.

**1214 - The Cost of Producing Apples in Western Colorado** (2). — THOMSON, S. U. and MILLER, G. H., in *U. S. Department of Agriculture (Office of Farm Management) Bulletin No. 500*; pp. 1-44. Washington D. C., March 14, 1917.

The study of apple production discussed in this bulletin, the second of a series of bulletins on the cost of apple production (3) was made during the years 1914 and 1915 in the Grand Valley and adjacent districts of Western Colorado. This area was chosen as being representative of a region which is not only of great present commercial importance, but has a large acreage of young orchards not yet in bearing. All apples are grown under irrigation, principally on comparatively small farms.

The data presented were obtained through detail studies of the orchard practices of 125 representative apple growers, 49 of whom were located in Mesa County, 61 in Delta County and 15 in Montrose County.

The factors considered in arriving at the annual cost of apple production have been classified as follows :

Labour		Costs other than labour	
Maintenance	Handling	Material costs	Fixed costs
Manuring	Hauling box shooks	Box shook	Taxes
Pruning	Making boxes	Nails	Insurance
Disposing of brush	Hauling loose boxes out	Paper	Water rent
Ploughing	Picking	Labels	Equipment charge
Cultivating	Hauling full boxes in	Spray materials	Machine hire
Irrigating	Sorting	Manure	Interest
Thinning	Packing	Gasoline, oil, etc.	Building charge
Spraying	Nailing		
Miscellaneous	Other packing labour		
	Haul to station		

(1) On this subject see *B.*, 1914, No. 845.

(2) See *R.*, February 1916, No. 224.

(3) Cfr. *U. S. Dep. of Agric. Bulletin No. 446: The Cost of Producing Apples in Wenatchee Valley, Washington*, and *Bulletin 518: The Cost of Producing Apples in Hood River Valley, Oregon*. (Ed.).



It was found that the total cost of production for the 125 farms representing the entire region averages \$ 0.844 per box. Labour costs average \$ 0.394 per box and \$ 111.88 per acre (46.7 % of the total cost). Material and fixed costs (manure, spray materials, etc.) average \$ 0.45 per box and \$ 127.91 per acre (53.3 % of total cost). Of this cost the principal item is interest on investment in orchard, which is \$ 0.184 a box, or 21.8 % of the total cost. The average yield for the district is 284 boxes per acre ; 3.8 per tree. The trees in orchards studied average 17 years of age and 74 to the acre. Jonathan is the leading variety, with Ben Davis, Rome Beauty, Gano, and Winesap following, each of about equal importance.

**Conclusions.** — Averages secured in this study seem to warrant the following conclusions as to fruit farming in the Grand Valley and adjacent districts :

The majority of farms are not sufficiently diversified to secure the best results ; the farms studied were prosperous in direct proportion to the degree of diversification practiced. Orchards must be set in suitable and well drained soil. Clean cultivation can not be practiced indefinitely without depleting the soil seriously. Humus should be supplied either in the form of manure or by using cover crops. In general it seems inevitable that fruit growers must find important supplemental sources of income to tide them over years of low fruit prices. Fruit growing combined with general farming will probably be more successful financially than fruit growing alone.

## AGRICULTURAL INDUSTRIES.

### INDUSTRIES DEPENDING ON PLANT PRODUCTS

**1215 — Unripe Grapes in Wine-Making in the Argentine.** — GALLI, GIACOMO, in the *Gior-nale Vinicolo italiano*, Year 43, No. 40, pp. 472-473. Casale Monferrato, October 7, 1917.

Following on experiments made by M. PIERRE CASENAVE at Mendoza on the use of unripe grapes in wine-making in the place of tartaric acid, and published in 1916, the writer describes his experiments, which lead to the same conclusions as those of M. CASENAVE.

Towards the middle of January 1917 (a period corresponding, in the southern hemisphere, to our summer), the writer gathered green grapes and dried them in the sun. Part of the juice was expressed ; the acidity of this juice was 24 degrees, expressed in terms of tartaric acid. Exposed to the extremely hot sun, the writer considered the grapes to be ready for use after 7 days, when they were crushed in a small mill; 100 kg. of unripe grapes yielded 14.5 kg. when dried.

In the first days of March, ripe bunches of the *Criolla* variety were gathered ; they gave a density of 12 ½ Baumé and a total sulphuric acidity of 2.695 %.

To this must, 13 gm. of dried, crushed grapes were added per litre. 8 days after, the clear liquid was drawn off ; the alcohol was found to be 13.800, the acidity 4.700, and the volatile acidity 0.60 per thousand.

To increase the *total acidity* in  $\text{H}_2\text{SO}_4$  by one degree in the must, 6.5 gm. of dried grapes were required per litre, or 650 gm. per hectolitre, equivalent to 5.520 kg. of acid grapes.

As ripe grapes cost 5 centavos the kg. that year, the cost per hectolitre and per degree of acidity was, in round figures, 30 centavos. With European tartaric acid, which now is very expensive, the corresponding cost would have been 50 centavos.

The author concludes, like M. CASENAVE, that the use of unripe grapes in the place of tartaric acid would, because of the over production of wine and grapes in the Argentine, result in a national economy of about 3 million francs in that country.

**1216 - The Reduction in Volume of the Must During Fermentation** (1). — BORNTRAEGER, A., in the *Giornale vinicolo italiano*, No. 26, pp. 302-304; No. 37, pp. 436-437. — DE ASTIS, G., *Ibid.*, No. 29, p. 340; No. 42, pp. 496-497. Casale Monferrato, 1917.

After the account of the experiments of M. DE ASTIS who, in his calculation of the decrease in volume of the must in fermentation, started from glucose, M. BORNTRAEGER shows that, according to his own calculations, starting from saccharose, he has obtained different results, in that not only no decrease in volume has taken place, but he has observed a slight increase in volume owing to chemical changes. He considers the formula of M. DE ASTIS and adds that the practical experiments of that author, made with filtered Tuscan must, showed an actual decrease of 0.345 and 0.310 %, figures which are intermediate between those obtained by M. DE ASTIS and himself.

M. DE ASTIS does not accept M. BORNTRAEGER'S results and is of the opinion that he has made a mistake in his calculations in assuming that 100 gm. of saccharose in 10 or 20 % solution would occupy a volume of 55 cc., while the true volume is 63.23 cc.

After M. BORNTRAEGER has replied, defending his point of view, M. DE ASTIS insists on his opinion, using as support that of M. MANOURY (President of the *Association des Chimistes de Sucrierie et de Distillerie de France et des Colonies*), according to which the volume in question is 64.702 ccs., a figure close to his own.

During the discussion, M. DE ASTIS corrects the formula that he had given for calculating the diminution in volume, namely :

$$C = \frac{Z}{1.613} - [(a - (a + 0.0686)]$$

in which  $C$  is the decrease in volume,  $Z$  the number of grams of sugar in 100 cc. of the must, 1.613 the density of glucose at  $17.5^\circ\text{C}$ .,  $a$  the % volume of alcohol in the wine, and 0.0686 the index of contraction for each degree of alcohol.

Through further research, M. DE ASTIS has been brought to modify the value of the index of contraction. In fact, when 53.9 cc. of alcohol are mixed

(1) See R., July 1917, No. 667.

(Ed.)



with 49.8 cc of water, the contraction is as 3.70 is to 103.70, corresponding to 3.586 %. The index is therefore :

$$\frac{3.586}{5.9} = 0.0662, \text{ and the formula becomes ;}$$

$$C = \frac{Z}{1.613} - [(a - (a + 0.0662))].$$

## 1217 — Contribution to the Study and Treatment of the "Casse Blanche" of Wines.

— MOREAU, I. and VINET, B., in the *Bulletin de la Société des Agriculteurs de France*, September, 1917, pp. 267-271, and October 1917, pp. 292-299. Paris, 1917.

The writers describe the disease of white wines called "*casse blanche*" and treat of its history, specially considering the latest work on this subject.

Since 1907, the writers have examined a number of well defined cases of *casse blanche*, and the examination of these diseased wines has led them to carry out researches on the subject, with the idea : 1) of ascertaining the exact part played by *iron* and *phosphoric acid* in the disease ; 2) of studying the influence of the composition of the wine and of aeration on *casse blanche* and finding out the conditions under which the two related diseases, "*casse bleu*" or "*tanno-ferric*", and "*casse blanche*" or "*phospho-ferric*" are produced ; 2) of ascertaining the best treatment for preventing *casse blanche*.

I. — PART PLAYED BY IRON AND PHOSPHORIC ACID. — The writers' experiments have led to the conclusion that *casse blanche* is in relation with the *iron salts* and *phosphates* in the wine. Any increase of iron (contact with storage utensils, especially with rusty iron) and phosphoric acid (e. g. addition of ammonium phosphate) in the wine may cause *casse blanche*.

II. — INFLUENCE OF THE COMPOSITION OF THE WINE AND OF AERATION. — A) PART PLAYED BY THE ACIDS OF THE WINE AND POTASSIUM BITARTRATE. — 1) *Action of tartaric acid*. — The free tartaric acid of the wine has a very favourable reaction as regards the disease, which explains why *casse blanche* is particularly common in the northern vinegrowing regions and in years of high acidity, that is, of incomplete maturity, when the wines are rich in free tartaric acid, and which explains why deacidified wines are practically always free from *casse blanche*. Deacidification, in fact, chiefly acts on the tartaric compounds : on free tartaric acid only, if the neutral potassium tartrate is used ; on tartaric acid and the bitartrate, if calcium carbonate is used.

2) *Action of potassium bitartrate, malic acid and succinic acid*. — The favourable action of these acid substances, even when added simultaneously, is much below that of tartaric acid.

3) *Action of citric acid*. — The writers' tests confirm and amplify previous knowledge on the function of citric acid, which is : a) that this acid, used in the legal amount of 0.5 grm. per litre is not always sufficient to prevent the appearance of *casse blanche* ; on the other hand, the use of 1 grm. per litre always prevents it ; b) that, in diseased wines, even when 1 grm.

(1) See also R., April 1917, No. 367.

(Ed.).



per litre is used, the citric acid does not always successfully dissolve the precipitate formed, but helps the agglutination and deposition of the ferric phosphate in suspension.

4) *Influence of tannic matter : casse blanche and casse bleue.* In a wine affected with casse blanche, the tannin perceptibly adds to the extent of the disease and modifies it to a bluish colour ; this special casse blanche should not be confused with the casse bleue, where the precipitate contains no phosphoric acid or only traces ; in this case the mineral composition of the precipitate is unchanged.

B) INFLUENCE OF AERATION. — Aeration favours casse blanche on account of the purely chemical function of its oxygen ; the phosphoric acid and the iron of the wine combine to form a ferrous phosphate, the wine being, by reason of its affinity for oxygen, a reducing medium ; this ferrous phosphate, during the aeration of the wine that always takes place during wine-making, oxidises slowly, forming ferric phosphate which is only slightly soluble in wine ; the casse blanche precipitate may then appear.

III. — TREATMENT OF CASSE BLANCHE. — The disease can be prevented, or cured, in two ways, according to the case : 1) by treating wines of average, or less than average, acidity with citric acid ; 2) by treating "green" wines with *deacidifying* agents. In the latter case, it must not be forgotten that preventive treatment is much more desirable, and it affords still another reason for advising the deacidification of musts in years of high acidity.

1218 — **The By-Products of Alcoholic Fermentation.** — LINDET, J., in the *Bulletin de l'Association des Chimistes de Sucrierie et de Distillerie*, Vol. XXXV, Nos. 7-9, pp. 232-236. Paris, January-February, 1917.

Commissioned by the Powder Department to specify the economic conditions under which foreign brown sugar, deprived of its food substances for yeast, is capable of supplying alcohol on distillation, the author sought to discover whether the by-product of alcoholic fermentation (observed by PASTEUR and estimated by him at about 6 % of the sugar, represented by glycerin, succinic acid, higher alcohols and by the excretion products of the old globules, even, at times, by yeast itself) is perceptibly constant or varies with the difficulties met by the yeast in forming and maintaining itself, in consequence of the value of the food with which it is supplied.

The author admits that all which is not alcohol and carbonic acid corresponding to GAY-LUSSAC's formula, all which is not formed by the zymastic action of the yeast, is a by-product derived from the life activities of the globules. He does not calculate this by-product as an absolute value, but expresses it per unit of yeast obtained.

His experiments, which he describes, led to the following conclusions:

Saccharose is a bad food for yeast, and, in its presence, ammoniacal salts change into proteins with great difficulty. This is not the case when more assimilable carbohydrates are added to the sugar ; the synthesis of the proteins becomes almost as easy and as rapid as if a ready-formed protein had been added to the yeast. The by-product per unit of yeast obtained, as defined above, may thus be used to measure the value of the

food supplied to the yeast. It is more abundant in proportion as the amount of yeast obtained is smaller, i. e., the efforts of the yeast to effect the synthesis of its carbohydrates are greater, in other words, as the value of the food decreases.

**1219 — Inversion of the Saccharose in Cane Sugar under the Influence of Microorganisms, at Java.** — AMONS, W. J. TH., in *Archief voor de Suikerindustrie in Nederlandsch-Indië*, Year 125, Pt. 29, pp. 1225-1231. Soerabaja, 1917.

It has long been known that certain microorganisms invert the saccharose in cane sugar. This action has been attributed by some workers to bacteria, by others, to the presence of *Penicillium glaucum*.

The author was able to study this problem in samples of cane sugar which had become hygroscopic after packing. By making agar-agar cultures he was able to isolate from these samples various fungi, among others: — *Aspergillus niger*, *A. fumigatus*, *A. flavus*, *A. clavatus*; *Penicillium glaucum*, *P. purpurogenum* (Stoll); *Rhizopus*.

In order to demonstrate the injurious action of these microorganisms, a sugar from the same source, still normal at 110° C., was sterilised, half was infected with the spores of the fungi, the whole lot covered and placed under a bell jar in which the moisture was kept equal to that of a saccharose solution at normal temperature.

When the mycelium develops and forms invertase, the saccharose is changed into glucose and fructose, more hygroscopic than saccharose. By determining the weight of the infected and uninfected sugar at regular intervals it is possible to follow the progressive action of the fungi on the sugar. The samples on which the fungi have acted weigh more on account of their high moisture content.

Up to the 8th, day all the samples, whether infected or not, increased in weight as a result of the condensation of water on their surface in the moist atmosphere in which they had been placed.

After the 8th. day the infected sugar increased in weight, whereas the other samples did not change.

After the 14th. day fungi had developed in all the samples and it was no longer possible to control the results of the experiment.

Another experiment, carried out with a pure culture of *Penicillium glaucum* under completely sterile conditions, gave similar results.

From this it seems that *Penicillium glaucum* alone is capable of spoiling sugar. The inversion depends on the quality of the sugar, the moisture, etc. It is probable that other microorganisms have a similar action under conditions favourable to their development.

**1220 — The Use of Chestnuts in Breadmaking.** — I. DE MARCILLAC, II. LINDET, III. MANGIN, LOUIS, in *Comptes rendus des Séances de l'Académie d'Agriculture de France* Vol. 3, No. 32, pp. 942-947. Paris, October 24, 1917.

I. — M. DE MARCILLAC, after giving the composition of the chestnut according to WOLFF and pointing out its high food value, states that M. DE ROUX, an agriculturist of Haute-Vienne, mixed chestnut flour with wheat flour in the proportion of 1: 2. He thus obtained an excellent bread, which,



however, should be salted rather more than ordinary bread to attenuate the taste of the chestnut.

Two objections may be raised to the use of chestnuts in breadmaking: — the question of decortication and that of labour. The skin, however, the weight of which varies from 15 to 20 % of the weight of the chestnut, or  $\frac{1}{5}$  th. of the total weight, comes off of itself when the fruit is dried; rubbing and energetic winnowing suffice to free the edible parts from any particles which may adhere to them; as, for use in breadmaking, it must always be ground and made into flour, the difficulty is easily overcome.

The labour question for the harvest could easily be mastered by employing schoolchildren.

II. — M. LINDER is of opinion that, to use chestnuts for breadmaking, it is sufficient to dry the fruit till the skin comes off of its own accord, and to grind the chestnuts thus decorticated into flour. The baker would then have no more difficulty in mixing it with wheat flour than he has when using barley or maize flour. Chestnut flour is, therefore, desirable as a substitute for cereals in breadmaking.

III. — M. LOUIS MANGIN points out that chestnuts easily spoil and are very difficult to keep. When dried in an oven by methods which are often primitive they always have a bad taste. They are often attacked by a fungus which soon blackens the flesh and turns the flour bad. It is not always easy to distinguish healthy fruit from diseased fruit.

Answering this point M. DE MARCILLAC said that he did not believe the chestnut was attacked by this disease while still on the tree. In order to diagnose this disease in Limousin, the chestnuts are plunged into water and stirred frequently for 4 or 5 days; all those which rise after this operation are bad.

1221 — Preparation and Fermentation of cacao in the Philippines. — See No. 1160 of this Review.

1122 — The Estimation of Rubber in Latex. — See No. 1207 of this Review.

1223 — On the Formation of "Eyes" in Emmenthal Cheese. — CLARK, W. M., in *Journal of Dairy Science*, Vol. 1, No. 2, pp. 85-113. Baltimore, U. S. A., July, 1917.

A review of the literature by the writer reveals little or no evidence that the eyes of Emmenthal cheese are strictly localized at points of excessive bacterial growth. On the contrary, the evidence of bacterial counts, and direct microscopical examination, as well as the gas production of different regions of the cheese, indicate a more or less uniform distribution of the eye-distending gas.

Certain theoretical considerations are presented which lead to the hypothesis that the gas separates in aggregates according to the laws governing the separation of gas from supersaturated aqueous solutions. This hypothesis has been tested upon viscous media with results directly applicable to the "eye" and "Nissler" hole formation in cheese. It is concluded; — that the gas produced in Emmenthal cheese separates in aggregates whose localities have no necessary relation to the points where the gas is produced; that a rapid gas production must tend to the formation



of numerous small holes, while a slow gas production must admit the formation of larger holes. This conclusion is shown to agree with the fact that Nissler holes are produced by a rapid fermentation, while eyes are formed slowly. This conclusion also suggests that the gas of Nissler holes must separate at numerous points near its point of origin without regard to any particular locality of the cheese, while the eyes must form at favourable points.

This was experimentally verified by a study of stained cheeses.

1224 — **Estimation of Water in Cheese.** — See No. 1209 of this *Review*.

1215 — **The Present Economic Superiority of Pork over Beef.** — See No. 1184 of this *Review*.

1226 — **The Fish Canning, Guano and Oil Trade in British India.** — See No. 1198 of this *Review*.

1227 — **The Handling and Storage of Apples in the Pacific North West.** — RAMSEY, H. J., MC KAY, A. W., MARKELL, E. I. and BIRD, H. S., in *U. S. Department of Agriculture, Bulletin No. 587*, 32 pp. + 7 coloured plates. Washington, September 8, 1917.

During the seasons 1911-1912 to 1914-1915, inclusive, extensive investigations were conducted by the United States Department of Agriculture to determine those factors which are of the greatest importance to the successful cold storage of the apples of the Pacific Northwest. For this purpose, apples were secured from the various more important apple-growing sections of Washington, Oregon, Idaho and Montana.

The experiments conducted at 32° F (0° C.) storage showed: A wide range in the cold-storage keeping qualities of different varieties, depending upon the decay, skin blemish, texture changes, etc., which they develop.

A 2-weeks' delay between the picking and storage of apples often greatly reduces their keeping properties through more rapid ripening and the development of scald, Jonathan spot, scab (due to *Venturia inaequalis* and *V. pomi*) and decay.

A temperature of 32° F will keep apples longer and in better condition than will a 35° F temperature, the difference in favour of the former increasing with the time in storage.

Immature picking results in severe scald and early decay of apples in storage.

The storage of over-mature apples is equally bad, or worse, than the storage of immature apples, resulting in more rapid deterioration than with those picked and stored at proper maturity.

Well-coloured portions of the skin seldom, if ever, develop scald.

Carelessness in handling is responsible for considerable decay of apples in storage, and freedom from bruises and skin abrasions is fundamental to successful storage.

Apples from orchards badly infected with northwestern anthracnose are likely to decay early in their storage life.

In conclusion, it is pointed out that successful cold storage of apples is as much the result of the treatment they receive before being placed in

cold storage, as of the conditions and temperatures under which they are kept in storage. The responsibility rests as much with the producer and handling organisations as with the cold-storage warehousemen.

1228 - **Report of the Committee on Statistics of Milk and Cream Regulations of the Official Dairy Instructors' Association of the United States.** — In the *Journal of Dairy Science*, Vol. I, No. 1, pp. 45-83. Baltimore, U. S. A., May, 1917.

This survey of the milk and cream regulations of the cities and towns of the United States, includes 194 headings and sub-headings pertaining to laws and ordinances designed to regulate the production, care and sale of milk and cream and presents a mass of statistics of particular interest to all persons interested in this problem.

The order in which the different arguments are discussed is the following: Permits of licenses; Chemical composition; Bacteria; Temperature; Specific gravity; Conditions which render Milk Unsalable; Parturition; Tuberculin testing of cows; Stables; Stable Yards; Water Supply; Milkers; Milk house; Milk utensils; The Scoring of Dairy Farms; City Milk plants; Delivery waggons; Labeling and sale; Penalties.

Out of this survey of milk and cream regulations of the cities and towns and states of the United States, the committee has concluded that:

1) there is a great and urgent need that the definite information now available should be placed in the hands of those who are responsible for the laws and ordinances governing the production, transportation, handling and sale of milk; and

2) there is a great and urgent need for further research and study on the part of dairy investigators of some of the problems involved in the production and handling of milk.

## PLANT DISEASES

### DISEASES NOT DUE TO PARASITES OR OF UNKNOWN ORIGIN.

1229 — **Experiments on Potato Leaf Curl, in France (1).** — BLANCHARD and PERRET, in *Comptes rendus des Séances de l'Académie d'Agriculture de France*, Vol. III, No. 31, pp. 894-895. Paris, 1917.

The experiments, carried out in 1914 in the Department of the Loire, do not permit the cause of this disease to be diagnosed with certainty. At the most they prove that, if there be parasitism, infection takes place neither through the soil nor through the skin of the tuber. The investigations must be continued another year.

Numerous observations made on extensive crops seem to point to the fact that leaf curl is a purely physiological disease. The disease appears to show a kind of degeneration in certain varieties of potatoes, due to excessively prolonged asexual reproduction, too frequent replanting in the same soil, cultivation in soils containing sufficient potassium but too little nitrogen (the element which favours the development of the leaves). It seems to prove that the plant is suffering from nitrogen starvation, or rather, that it has difficulty in assimilating this element.

From a practical point of view of it should be noted : —

- 1) That all varieties are not equally subject to the disease ;
- 2) That all plants of the same variety are not equally attacked ;
- 3) That fresh seed and nitrogenous manure diminish the disease.

Therefore, until an efficacious remedy is found, it is advisable : —

1) To grow the most resistant varieties in each district ("Violette d'Auvergne", "Andréa", "Fluck géante", "Saucisse rouge", in the central Massif district);

2) to renew the seed potatoes frequently ; in the Loire district especially, seed potatoes introduced in large quantities from the west, have given the growers entire satisfaction ;

(1) On this subject see : *B.* Jan. 1911, No. 286 ; *B.* Feb., 1911, Nos. 594 and 622 ; *B.* June, 1911, Nos. 1881 and 2020 ; *B.* April, 1912, No. 728 ; *B.* June, 1914, No. 580 ; *B.* July, 1914, No. 683 ; *B.* Sept., 1914, No. 858 ; *B.* April, 1915, No. 366 ; *R.* May, 1916, No. 558 ; *R.* August, 1916, No. 851 ; *R.* June, 1917, No. 542.



3) to select, at harvest times, good varieties ; in other words, to choose the spring seed potatoes from the most productive and strongest plants ;

4) to give the plantation a minimum of 220 cwt. of well prepared farmyard manure ;

5) to apply the nitrogen treatments late.

Copper treatment, so efficacious against mildew, has no effect on leaf curl.

1230 - **New Disease of the Pineapple in the Philippines.** — MACKIE, D. B., in *The Philippine Agricultural Review*, Vol. X, No. 2, p. 150, pl. XVII. Manila, 1917.

In the Philippines at Binān (prov. of Laguna) and at Pinelands (prov. of Nueva-Ecija) a disease has appeared on varieties of pineapple known as Smooth Cayenne and Queen which, should it spread, might seriously threaten the pineapple industry. The disease causes a hypertrophy of the tissues, which gives them a rough corrugated appearance. It has also been noticed that the suckers prepared for shipping which show these same corrugations often develop a heart rot, causing the whole heart to become shiny and easily pulled out. This rot has been observed on about 10 per cent of the suckers which also showed the corrugations.

In Hawaii (islands of Kauai) and Oahu there is a disease of pineapples which has been subjected to local quarantine. This disease is believed to be the same as that now recorded in the Philippines.

Affected plants should be pulled out and burnt, also particular care should be exercised that no infected suckers are used for distribution or propagation.

1231 - **The "Little Leaf" Disease of the Vine in California.** — BIOLETTI, FREDERIC T. and BONNET LEON, in the *Journal of Agricultural Research*, Vol. VIII, No. 10, pp. 381-397, fig. 1-2, pl. 89-92. Washington, D. C., 1917.

A disease of the vine (*Vitis* spp.) known variously as "little leaf", "curly-leaf", and "yellow-leaf", first attracted attention in California about the beginning of the century. Some growers claim to have noticed it earlier, but no printed reference has been found that points clearly to this disease before 1900. Most of the vines in many districts where it is prevalent have been planted since that date.

At present, many vines are attacked in various regions from the borders of Sacramento and San Joaquin Counties, to the southerly end of the San Joaquin Valley. No indubitable cases have been noted in the Sacramento Valley, south of Kern County or in any part of the coast region. The total area attacked is difficult to estimate, but it is large. In some localities, only occasional vines, or small spots are affected, in others, most of the vines show more or less intense symptoms. The loss in crop is large, and equally difficult to estimate.

The disease seems to be unknown elsewhere, unless a form of "court noué", noted in Northern Mexico and Southern Europe, is identical.

Affected vines show small yellowish leaves, short-jointed canes, and in severe cases, dead spots on the leaves and gummy secretions in the conducting tissue of the arms and trunk. In severe cases, the vines die after a few

years. Vines slightly affected set fruit imperfectly, and those badly affected bear little or nothing.

No parasite has been found connected with the disease, and the evidence seems to show that it is not infectious. Everything seems to point to the malady being due to local conditions of soil, water, temperature, or other non-parasitic causes.

The disease has been noted on various species of *Vitis* and none has proved immune. It has been found on the following phylloxera-resistant stocks: *Riparia gloire de Montpellier*, *Rip. grand glabre*, *Rupestis St George*, *Vitis aestivalis*, *V. Champini*, *V. Doaniana*, *Berlandieri* × *Riparia* 157-11, *Rip.* × *Rup.* 101-14, 3306, 3309, *Rip.* × *Cord.* × *Rup.* 106-8, *Sol* × *Rip.* 1615, 1616. All varieties of *Vitis vinifera* are attacked, but a few seem to be peculiarly susceptible, and a few others to have some considerable degree of resistance. The Mataro is so badly affected, as to make a class by itself, although the Carignane is almost as bad. Examples of partial resistance have been noted with Black Prince, Burger, Sultanina, Valdepeñas, Petite and Alicante Bouschet. Vines belonging to the varieties Muscat, Tokay, Palomino, Feher Szagos, Zinfandel, Malaga, Green Hungarian and Grenache have been found badly infected in considerable quantities. Grafted vines seem to be as susceptible as vines on their own roots.

Several kinds of trees are attacked by what seems to be the same trouble. *Populus monilifera* var. *angulata* appears particularly susceptible; the same may be said of the apricot. Other trees (peach, walnut, almond, fig. *Melia Azedarach* var. *umbraculiformis*) show similar symptoms, but the resemblance to the affection of the vine is less marked than in the case of *P. monilifera* var. *angulata* and the apricot.

No effective method of treatment has yet been found; though an experiment carried out under the direction of the California Agricultural Experiment Station on a small vineyard of 176 old Tokay vines, of which the half were severely infected, and the others healthy or slightly affected, showed that the application of gypsum to the soil is beneficial to plants suffering from "little leaf".

## DISEASES DUE TO FUNGI, BACTERIA AND OTHER LOWER PLANTS.

### GENERAL

1232 -- Plant Diseases Recently Observed for the First Time in Canada. — GUSSOW, H. T., in *Science*, New Series, Vol. XI, VI, No. 1189, p. 362. Lancaster, Pa., 1917.

Two cryptogamic plant diseases have recently been observed in the Dominion of Canada which have not been recorded before: *Dothichiza populea* Sacc. and Briard on *Populus nigra* var. *italica* at St. Andrews (New Brunswick), and *Colletotrichum cereale* Manns on spring wheat, Charlottetown (Prince Edward Island).

A third disease affecting seed pods of turnips grown for seed in Prince Edward Island caused by *Leptosphaeria Napi* (Fuckel) Sacc. of which the co-

nidial form, *Sporidesmium exitiosum* Kuhn was found, does not appear to have been recorded as causing trouble on the continent of America. It is well-known in Europe, where it is disastrous to seed turnip (*B. rapa*) cultures.

**1233 — Myxomycetes and Fungi of Piedmont, Italy (1).** — NOELLI, ALBERTO, in *Nuovo Giornale botanico italiano*, New Series, Vol. XXIV, No. 3, pp. 183-197. Florence, 1917.

Ten species of myxomycetes and 101 species of fungi properly speaking are enumerated. All were collected at different times by different people, especially in the mountain and hill districts of Piedmont.

Four species are new, amongst them *Lachnella Cerasi*, on the bark of *Prunus Cerasus* at Levone Canavese, November 1912, and *Cladosporium acerinum* on the branches of *Acer Negundo* (*Negundo aceroides*), at Bruere (Rivoli), March 29th., 1915.

**1234 — Fungi of North Dakota, United States of America.** — BRENCHE, J. F., in *Mycologia*, Vol. IX, No. 5, pp. 275-293. Lancaster, Pa., 1917.

In this list, an attempt is made to bring together all known North Dakota fungi mentioned in earlier lists and papers, as well as those collected during the past 7 years.

The list mentioned above contains the names, arranged in alphabetical order, of 22 phycomycetes and 271 ascomycetes.

The data accompanying the specific names relate to the host-plants or substratum, the locality and the date of collection: the name of the collector is also given, unless in the case of species found by the writer himself.

**1235 — Swedish Varieties of Winter Wheat Resistant to Rust, Lodging and Cold.**  
— See Nos. 1146-1147 of this Review.

RESISTANT  
PLANTS

**1236 — Wild Hops of the United States Resistant to Disease and Climatic Changes.**  
— See No. 1142 of this Review.

**1237 — Tables Grape Hybrid Bearers Resistant to Disease.** — See No. 1169 of this Review.

**1238 — Hybrid Direct Bearers Resistant to Fungous Disease, in Seine-et-Marne, France.** — See No. 1170 of this Review.

**1239 — The "Madone" Vine Resistant to Mildew and Oldium, in Aude, France.** — See No. 1171 of this Review.

**1240 — Chinese Chestnuts (*Castanea mollissima*) Resistant to Bark Disease.** — See No. 1129 of this Review.

(1) See also *B. Nov.-Dec.*, 1911, No. 3221; *B. Sept.*, 1912, No. 1351; *B. Nov.*, 1912, No. 1573; *B. July*, 1913, pp. 1000-1005; *B. June*, 1915, No. 650; *B. Sept.*, 1915, No. 984; *R.*, Feb. 1917, Nos. 191 and 205; *R. July*, 1917, Nos. 680 and 686-687. (Ed.).



1241 - *Fusarium coeruleum* the Cause of the Dry Rot of the Potato Tuber in the British Isles (1). — PETHYBRIDGE, GEORGE H., and LAFFERTY H. A., in *The Scientific Proceedings of the Royal Dublin Society*, Vol. XV (New Series), No. 21, pp. 193-222. Plates VI-VII, Dublin 1917.

The dry-rot of the potato tuber which commonly occurs in the British Isles is caused by *Fusarium coeruleum* (Lib.) Sacc. The 2 species, *F. oxysporum* Schlecht, and *F. trichothecioides* Woll., which are largely responsible for a somewhat similar type of rot in certain parts of the United States of America, have not been met with in this connection up to the present in the British Isles.

On a single occasion, *F. arthrosporioides* Sherb. was found, and proved to be capable of causing a dry-rot of the potato tuber. Further research may perhaps show that this, and possibly some other species of *Fusarium*, are occasionally responsible for the production of dry-rot in Britain.

*F. coeruleum* does not produce hadromycosis of the potato plant, nor does it kill the latter by attacking its roots. It can destroy tomato fruits but does not attack onions, mangels, carrots, parsnips, or apples.

Infection frequently occurs through mechanical wounds, such as those caused by implements, by bruising and by breaking off the sprouts. It may occur also through scab spots (*Oospora Scabies*). Wounds, however, are not essential, for infection can take place through the lenticels, eyes, or young sprouts of uninjured tubers.

Potatoes become more susceptible to infection as they become more mature, hence the rot is more prevalent during the later than during the earlier period of storage. Some varieties of potato (Eclipse, Windsor Castle and Epicure) are more resistant to infection than others.

Affected tubers cannot be cured, and the application of sulphur or lime for preventing infection or retarding the rot, is of no practical value.

1242 - The Control of Canker (*Phytophthora Faberi*) of the Cocoa-tree, in Java (2). — HALL, C. J. J. VAN, in *Mededeelingen van het Laboratorium voor Plantenziekten*, No. 30, pp. 1-10. Batavia, 1917.

In spite of rigorous treatment by the Ceylon method, which consists in a radical cutting of the infected parts of the cortex, a large number of cocoa-trees of the "criollo" variety in the Kimiri plantations were attacked by *Phytophthora Faberi*. The loss, in 1912, amounted to 1000 out of 17 000 trees in one plantation. From 1912 onwards the method recommended by the author has been followed. This consists of a radical pruning of the tree, Bordeaux mixture treatment, superficial scraping of the cankerous parts of the stems and the washing of these parts with 20 % carbolineum or vegetable tar. As preventative measure, boring-beetles were fought continually.

(1) See also *B.* September 1913, No. 1105; *B.* October 1914, No. 956; *B.* November 1914, No. 1070; *R.* October 1916, No. 1129; *R.* November 1916, No. 1232; *R.*, February 1917, No. 198.

(2) See also *B.* Jan., 1911, No. 316; *B.* Dec., 1912, No. 1686; *B.* Sept., 1913, No. 1107; *B.* March, 1914, No. 285; *B.* Nov., 1914, No. 1072; *B.* Feb., 1915, No. 228; *R.* Oct., 1917, No. 978; *R.* Nov., 1917, No. 1094. (Ed.)

A special staff undertook the pruning, and each tree was visited at least once a month.

The results of the treatment were very satisfactory and cocoa-tree canker may be considered as having disappeared from the plantations. In 1908-1912 there was an average of 5.4 % of dead trees per annum ; this loss, in 1913, was reduced to 2.8 % and, in 1915, to 0.7 %.

1243 - **Diseases of the Sweet Cinnamon Tree (*Cinnamomum Burmanni*), in Sumatra.** — See N. 1161 of this Review.

1244 - ***Bacterium Tabacum* Injurious to Tobacco in North Carolina, United States of America.** — WOLF, F. A., and FOSTER, A. C., in *Science*, New Series, Vol. XLVI, No. 1189, pp. 361-362. Lancaster, Pa., 1917.

A bacterial leaf spot of tobacco has been found to occur within certain sections of North Carolina. The disease, commonly known as "wild fire", manifests itself in seriously destructive form at the time of transplanting, so that in some fields it has been necessary to replace the seedlings by a second and third transplanting. Plants in the seedbeds from which these seedlings were taken have been found to be diseased, indicating that the malady was introduced from the seed beds.

The disease first appears as circular yellow spots about 1 cm. in diameter. A minute brown area indicates the centre of the spot. Within a few days the brown area grows to 2 or 3 cm. in diameter with a translucent border surrounded by a wide chlorotic halo. When the spots are numerous they fuse, forming large, brown, irregular areas, which in severe cases, involve most of the leaf tissues.

Isolation and inoculation work have shown that the disease is due to a greyish white bacterial organism which is so far undescribed. It is rod-shaped, about 3 times as long as wide, and actively motile owing to a single polar flagellum. It is therefore referable to Cohn's *Bacterium* as amended by Smith, and is given the name *Bacterium Tabacum*. The detailed account of the morpho-biological characters of this microorganism are reserved for subsequent publication.

1245 - **"Rust" (*Uredo Ricini*) of the Castor-Oil Plant in Morocco.** — ARNAUD, G., in *Bulletin de la Société de Pathologie végétale de France*, Vol. 4, Pt. 1, pp. 37-39. Paris, 1917.

The Plant Pathology Station of Paris received, from the Agricultural Department of Morocco, castor-oil leaves, attacked by *Uredo Ricini* Biv. gathered at Rabat at the beginning of February 1917. The samples were covered with numerous orange-yellow pustules of the fungus, containing uredospores, and there was no doubt that the parasite had caused considerable injury to the plant, the cultivation of which, judging by experiments already carried out, should, in the future, be very profitable in Morocco.

This rust, known for a long time, has been observed in Europe (Italy, in Piedmont, Liguria, Sardinia and Sicily ; Spain, at Seville, Cadiz, etc ; Portugal), in Asia (India, at Madras) and in Africa (southern Morocco, Me-



lilla, and now, at Rabat; Algeria, near Algiers; Tunis, at Gabes, Egypt, and, it seems, in certain districts in the south of the continent).

To reduce the damage caused by the parasite, it seems, above all necessary to find resistant varieties of the castor-oil plant, and to study the localities in which the disease spreads least.

1246 - The Discovery of Urediniae of *Cronartium Ribicola* on Stems of *Ribes hirtellum* in Maine, United States (1). — POSEY, G. B., GRAVATT, G. F., COLLEY R. H., in *Science*, New Series, Vol. XLVI, No. 1187, pp. 314-315. Lancaster, Pa. 1917.

Recently, urediniae of *Cronartium ribicola* Fischer have been discovered for the first time, on the stems of *Ribes hirtellum* Michx. (= *Grossularia hirtella* [Michx.], Spach.) growing in a pine plantation at Kittery Point (Maine). In the same woodlot, 2 other isolated plants of the same species inoculated with aecidiospores by applying the moistened aecidiospores to the unwounded green stems developed respectively 1 and 17 stem infections. Of the 17 infections some were very evidently natural infections, since they occurred at points on the stems where no aecidiospores had been applied.

Urediniae were produced on some of the stem infections from the middle of June until August 20. The uredospores which were formed in these sori were apparently normal in every way. In the case of the other stem infections, where no urediniae appeared, the study of sectioned material showed an abundance of mycelium and numerous well-formed internal urediniae in the cortex.

The discovery of sporulating urediniae on *Ribes* stems complicates the already difficult problem of detecting the disease on *Ribes*.

In view of the observations recorded above, it must be concluded that no *Ribes* from infected regions can be declared absolutely free from the rust, even when completely defoliated. Moreover, the presence of the mycelium and internal urediniae in stem tissue is strong evidence that the disease does in some cases winter over on *Ribes*.

1247 - The Treatment of Mildew of the Peach Tree (*Oidium leucoconium*). — SAVASTANO, L., in *R. Stazione sperimentale di Agrumicoltura e Frutticoltura, Acireale, Bollettino* No. 31, pp. 1-2. Acireale, 1917.

*Oidium leucoconium* Desm. develops regularly each year in the orchards of western Sicily.

The young peach trees sometimes do not lose their leaves in winter and the extremities of the twigs remain green and tender, so that the fungus not only hibernates in them, but also prepares the summer reproduction.

Peach mildew is not serious in itself, since only the ends of the twigs are attacked; but the persistent disease, renewed each year, shortens the life of the tree and compromises the bearing of fruit.

Of the remedies, potassium sulphate and lime-sulphur mixture scorch the plant. The author's experiments of 1916 showed sulphur to be preferable. The use of sulphur in this case is only efficacious if applied before



the mildew has a definite hold on the plant ; the sulphur treatment must be repeated each time a new attack by the parasite is to be feared. Sulphur, moreover, is beneficial to the growth of the tree.

1248 — **Scab (*Venturia Pomī*) and Other Diseases of Stored Apples, in the United States.** — See No. 1227 of this *Review*.

1249 — ***Armillaria mellea*, a Basidiomycete Injurious to the Walnut Tree, in France** (1). — GUINIER, PH., in *Bulletin de la Société de Pathologie végétale de France*, Vol. IV, Pt. 1, pp. 27-29. Paris, 1917.

The author had occasion to study a disease of the walnut tree in the Departments of Charente (near Ruffec) and Dordogne (in the district of Nontron and Thiviers), where it was very widespread ; he also observed it sporadically in Dauphiny and Savoy. The symptoms of this disease, as described by the land-owners, consist of a gradual dying off and yellowing of the leaves and drying up of the branches, finally ending in the death of the tree towards the end of the vegetative season.

At the base of numerous dead or dying trees, under the bark of the main roots, the author noticed the constant presence of rhizomorphs of various types, white or blackish. The smaller roots are completely rotten. At the foot of the dead trees, a short distance away along the line of the roots, are found groups of fructifications of *Armillaria mellea* Vahl. According to the author it is this fungus, so common on fruit trees, both as saprophyte and parasite, which is the cause of the disease in question, though agriculturists attribute it to meteorological conditions and, sometimes, to the dampness of the soil.

There are practically no means of protecting the walnut against the disease, but certain very simple preventative measures may be applied. First of all it should be noted that the trees attacked are especially old ones, weakened by numerous harvests, and that it is in poor soils, where little care is given the trees, that the disease is worst. Growers must tend the trees better and counterbalance the exhaustion of the soil by successive harvests by the addition of suitable fertilisers. The resistance of the trees to the disease will thus be increased.

In the second place, it is desirable that trees which are dying off completely be cut down without delay and uprooted with great care instead of being left standing in the hope that they will regain strength. If left they allow the fungus to fructify abundantly and increase the risks of infection of healthy trees. Diseased roots especially are left in the soil ; these may come into contact with the roots of neighbouring trees, thus spreading the disease. The danger is particularly great for young trees which are replanted in an impoverished and infected soil.

1250 — ***Polyporus amorphus*, Causing a Rot of the Wood of *Pinus rigida*, in Pennsylvania, U. S. A.** — OVERHOLTS, L. O., in *Mycologia*, Vol. IX, No. 5, pp. 261-270, pl. 12-13. Lancaster, Pa., 1917.

*Polyporus amorphus* Fries cannot yet be considered as a common fungus

(1) See also *B. Oct.* 1914, No. 962 ; *B. March*, 1915, No. 329 ; *B. Nov.*, 1915, No. 1211, *R.*, July, 1917, No. 686. (Ed.)

of the United States, as it has been recorded a few times only. It is, however, probably much more common than is indicated by existing collections. At present it is believed to be distributed through southern Canada, in New England and in the States neighbouring on the Canadian border.

According to observations made in the vicinity of State College (Pennsylvania), this polyporus causes a characteristic rot of the pitch pine (*Pinus rigida*); the fungus has also been observed on white pine (*Pinus strobus*), table mountain pine (*P. pungens*) and hemlock (*Tsuga canadensis*).

Affected wood appears of a darker colour than healthy wood; it is of a light brownish colour.

The spring wood is completely rotted well before the disappearance of summer or autumn wood. Thus gives rise to the formation of elongated cavities alternating with bands of more consistent summer wood and has suggested the popular name of "stringy rot".

Microscopic and microchemical examination have shown that the fungus first dissolves the cellulose of the medullary rays, then the areolar points. The lignified structures including the vertical and radial vessels are next attacked and finally (in the spring wood, at any rate) completely destroyed.

In consequence, it seems probable that the enzymes that dissolve the cellulose are produced in much larger quantity by the young mycelium, although there is the possible presence of an enzyme that dissolves lignin.

In the later stages of the rot, larger quantities of an enzyme dissolving lignin are produced.

## INJURIOUS INSECTS AND OTHER LOWER ANIMALS.

### GENERAL

1251 - The Abundant Occurrence of *Sphinx Convolvuli* in Scotland. — MAXWELL, HERBERT, in *Nature*, Vol. 100, No. 2500, p. 66. London, 1917.

Hitherto *Sphinx convolvuli* (the convolvulus hawk-moth) has been reckoned one of the rarer insects in Scotland. In the last 50 years, the writer has only known of 2 authentic records of its occurrence in Wigtownshire. In the autumn of 1917, however, it was very plentiful. One individual came into the author's house at Monteith on September 7; 8 others were caught in the neighbourhood of Perth; 7 more were observed in a garden at Monteith, while hovering round tobacco plants.

It is difficult to account for the sudden appearance of so many of these insects after many years of absence.

1252 - Insects Injurious to Cultivated Plants in North Africa. — RIVIÈRE, CH., in *Bulletin de la Société Nationale d'Acclimation de France*, Year 61, No. 10, pp. 401-402. Paris, 1917.

The spreading, in North Africa, of certain insects which have become endemic is a source of anxiety.

Phylloxera infection is increasing, the European vines are rapidly dying off and the re-planting of the vineyards with American stock is becoming urgent.

The polyphagous coccid *Chrysomphalus minor* Berl. is causing serious injury to oranges and to small-leaved figs, and resists all treatments which, moreover, are difficult to apply to big trees.

The "fruit fly" (*Ceratitis capitata* Wied), at present endemic, damages many fruits (oranges, tangerines, kakis, etc.) (1).

The "olive fly" (*Dacus oleae* Fabr.), in the winter of 1916, so damaged the harvest that, to save part of it, the olives had to be gathered while still green on the Sig (Oran) estate. The same disaster had occurred four years previously.

1253 - **Coccidae of the Philippine Islands.** — ROBINSON, ELIZABETH, in *The Philippine Journal of Science, Section D.: General Biology, Ethnology and Anthropology*, Vol. XII, No. 1, pp. 1-47, Plates I-VI. Manila, 1917.

A systematic description of the following coccids:

1) *Icerya jacobsoni*, Green, in Luzon Island (Laguna, Los Baños), on *Leucosyke capitellata*;

2) *I. candida*, Cockerell, at Luzon, Manila, on a cultivated tree;

3) *I. seychellarum* (Westwood), at Luzon, on *Rosa* (Tayabas, Lucban); on *Citrus decumana*, *Diospyros Kaki* and *Ficus Minahassae* (Laguna, Los Baños); on *Psidium Guajava* (Manila);

4) *Drosicha palavanica*, Cockerell, in the Island of Palawan (Puerto Princesa);

5) *D. lichenoides*, Cockerell, at Luzon (Laguna, Los Baños), on *Ficus nota* and other trees;

6) *Monophlebulus townsendi*, Cockerell, at Luzon (Batangas);

7) *Llaveia sanguinea*, Cockerell, at Palawan (Puerto Princesa);

8) *Ll. benguetensis*, Cockerell, at Luzon (Benguet, Baguio);

9) *Ll. luzonica*, Cockerell, at Luzon (Mount Maquiling, and Los Baños);

10) *Pseudococcus virgatus*, Cockerell, at Luzon (Laguna, Los Baños), on *Anona squamosa*, *Arachnis hypogaea*, *Caesalpinia pulcherrima*, *Codiaeum variegatum*, *Coffea arabica*, *Graptophyllum*, *Solanum*, *Spondias* and *Xanthosoma sagittifolium*;

11) *Ps. virgatus* (Cockerell) var., at Luzon (Tayabas, Lucban), on *Codiaeum variegatum*;

12) *Ps. tayabanus* Cockerell, at Luzon (Tayabas, Lucban), on *Theobroma Cacao*;

13) *Ps. lilacinus*, Cockerell, at Luzon (Tayabas, Lucban), on *Citrus nobilis*.

14) *Ps. filamentosus*, Cockerell, on Mindanao Island (Tanghulan), on *Coffea arabica*;

15) *Protopulvinaria longivalvata bakeri*, Cockerell, at Luzon (Laguna, Los Baños), on *Voacanga globosa*;

16) *Pulvinaria tyleri*, Cockerell, at Luzon (Batangas), on *Antigonon leptopus*;

(1) See also *R. Oct.*, 1916, No. 1155 and *R. May*, 1917, No. 513.

(Ed.)



17), *Pulv. polygonata*, Cockerell, at Luzon (Manila), on a cultivated tree ;

18) *Pulv. thespesiae*, Green, at Luzon (Laguna, Los Baños), on *Codiaeum variegatum* ;

19) *Pulv. psidii*, Maskell, at Luzon (Laguna, Los Baños), on *Antidesma bunius*, *Eugenia Jambos*, *Ficus* and *Psidium Guajava* ;

20) *Pulv. psidii philippina*, Cockerell, at Luzon (Tayabas, Lucena) on *Ficus* ;

21) *Ceroplastes gigas*, Cockerell, at Luzon (Laguna, Mount Maquiling), on an unknown tree ;

22) *Paralecanium luzonicum*, Cockerell, at Luzon, on *Plectronia viridis* (Laguna, Los Baños) ; on *Tetrastigma* (Laguna, Mount Maquiling) ;

23) *Paralec. cocophyllae*, Banks, at Luzon on *Cocos nucifera* (Manila) ; on *Dillenia philippinensis* (Laguna, Mount Maquiling) ;

24) *Platylecanium cribrigerum*, Cockerell and Robinson, at Luzon (Laguna, Los Baños) on *Piper Loheri* ;

25) *Saissetia oleae* (Bernard), at Luzon (Tayabas, Lucban), on *Gardenia* or *Jasminum* ;

26) *S. nigra* (Nietner), at Luzon on *Manihot utilissima* (Manila) ; on *Eriodendron anfractuosum* and *Witania origanifolia* (Laguna, Los Baños) ;

27) *S. hemisphaerica* (Targioni Tozzetti), at Luzon, on *Cycas circinnalis* and other cultivated plants ; on *Anona muricata* and *Calanthe* (Laguna, Los Baños) ;

28) *Coccus elongatus* (Signoret), at Luzon, on *Codiaeum variegatum* (Tayabas, Lucban) ; on *Anona squamosa* (Laguna, Los Baños) ;

29) *C. diversipes*, Cockerell, at Luzon (Tayabas, Lucban), on *Asplenium nidus* ;

30) *C. viridis*, Green, at Luzon (Laguna, Los Baños) on *Antidesma Bunius*, *Citrus decumana*, *C. nobilis*, *Gardenia florida* and *Strychnos Nux-vomica* ;

31) *Odonaspis schizostachyi* Cockerell and Robinson, at Luzon (Laguna, Los Baños), on *Schizostachyum acutiflorum* ; the colonies of this scale are usually completely covered by the fungus *Septobasidium Bakeri*, Patouillard ;

32) *Fiorinia floriniae* (Targioni Tozzetti) at Luzon (Laguna, Los Baños) on *Celtis philippinensis* ;

33) *F. phantasma* Cockerell and Robinson, at Luzon (Laguna, Mount Maquiling), on *Machilus* ;

34) *Aulacaspis rosae* (Bouché) at Luzon (Tayabas, Lucban), on *Rosa* ;

35) *Phenacaspis inday* (Banks), at Luzon, on *Cocos nucifera* (Manila) ; on *Mangifera indica* (Laguna, Los Baños) ;

36) *Phenac. eugeniae* (Maskell) at Luzon (Manila), on a palm ;

37) *Phenac. mischocarpi*, Cockerell and Robinson, at Luzon (Laguna, Los Baños), on *Mischocarpus fuscescens* ;

38) *Phenac. pellucida* sp. nov., at Luzon (Laguna, Los Baños), on *Macaranga Tanarius* ;

39) *Phenac. thoracica* sp. nov., at Luzon (Laguna, Los Baños), on *Morinda bracteata* ;

40) *Phenac. pallida* sp. nov., at Luzon (Laguna, Los Baños), on *Litsea* ;

41) *Chrysomphalus pedroniformis* Cockerell and Robinson, at Luzon, on *Eriodendron anfractuosum* (Bataan) ; on *Vitis vinifera* (Laguna, Los Baños) ;

42) *Chrys. aurantii* (Maskell), at Luzon, on *Artocarpus* (Manila), on *Astronia* (Laguna, Mount Maquiling) ;

43) *Chrys. aonidium* (Linnaeus), at Luzon, on *Artocarpus*, *Cocos nucifera*, and another palm (Manila) ; on a climbing aroid (Laguna, Mount Maquiling) ; on *Arenga saccharifera*, *Citrus nobilis*, *Cocos nucifera* and *Garcinia* (Los Baños) ;

44) *Chrys. rossi* (Maskell), at Luzon, on *A. saccharifera* and *Cycas circinnalis* (Tayabas, Lucban), on an orchid quarantined at San Francisco ; This was the first coccid to be recorded from the Philippine Islands.

45) *Schizaspidis lobata*, Cockerell and Robinson, at Luzon. (Laguna, Los Baños) on *Ficus nota* ;

46) *Parlatoria zizyphus* (Lucas), at Luzon (Laguna, Los Baños), on *Citrus decumana* ; recorded by SASSER on *Citrus* cuttings from the Philippine Islands ;

47) *P. proteus* (Curtis), at Luzon (Manila) on *Eugenia malaccensis* ;

48) *P. greeni*, Banks, at Luzon (Manila), on *Cocos nucifera* ;

49) *P. pergandii*, Comstock, at Luzon, (Manila) on an aloe-like plant ; on *Celtis philippinensis* (Laguna, Los Baños) ;

50) *Selenaspidus articulatus*, Morgan, found on *Citrus* cuttings, Philippine Islands ;

51) *Aspidiotus cydoniae*, Comstock, at Luzon (Laguna, Los Baños) on *Blumea balsamifera* and *Hibiscus mutabilis* ;

52) *A. cydoniae* var. *greeni* Cockerell, at Luzon (Laguna, Los Baños) on *Achras Sapota* and *Chrysanthemum* ;

53) *A. lataniae*, Signoret, at Luzon (Tayabas, Lucban), on "cabbage" (cabbage palm, *Euterpe oleracea*?) ;

54) *A. coryphae*, Cockerell and Robinson, at Luzon (Laguna, Los Baños) on *Corypha alata* ;

55) *A. destructor*, Signoret, at Luzon (Laguna, Los Baños). on *Cocos nucifera*, *Eugenia calubcob*, *Mangifera indica*, *M. verticillata* ;

56) *A. translucens*, Cockerell, at Luzon on *Anona squamosa*, *Aleurites moluccana*, *Carica Papaya*, *Cocos nucifera*, *Codiaeum variegatum*, *Dioscorea alata*, *Mangifera indica*, *Musa sapientum*, *Psidium Araca*, *Spondias*, *Tamarindus indica* (Laguna, Los Baños) ; on *Phoenix dactylifera* (Bataan, Linao) ; on coconut seedling (Tayabas, Lucban) ;

57) *A. tayabanus*, Cockerell, at Luzon (Tayabas, Lucban) on *Gardenia* or *Jasminum* ;

58) *A. rapax*, Comstock, at Luzon, Manila market on oranges from Southern California ;

59) *Pseudonidia obsita*, Cockerell and Robinson, at Luzon (Laguna, Los Baños) on *Ficus caudatifolia* ;

60) *Pseudaon. trilobitiformis* (Green), at Luzon (Manila), on *Artocarpus*;

61) *Pseudaon. circuliginis* (Green), at Luzon (Laguna, Los Baños), on *Corypha elata*;

62) *Lepidosaphes rubrovittatus*, Cockerell, at Luzon (Manila), on *Eugenia malaccensis*;

63) *L. lasianthi* (Green), at Luzon (Laguna, Los Baños), on *Cordiaum variegatum*;

64) *L. luzonica* sp. nov., at Luzon (Benguet, Baguio), on *Ficus*;

65) *L. ixorae*, Cockerell and Robinson, at Luzon (Laguna, Los Baños), on *Ixora coccinea*;

66) *L. cocculi* (Green), at Luzon on a palm (Manila); on *Erythrophalum scandens* (Laguna, Los Baños);

67) *L. mcgregori*, Banks, at Luzon (Manila), on *Cocos nucifera*;

68) *L. unicolor*, Banks, at Luzon (Manila), on *C. nucifera*;

69) *Hemichionaspis uvariae*, Cockerell and Robinson, at Luzon (Laguna, Los Baños), on *Uvaria* sp.;

70) *H. townsendi*, Cockerell, at Luzon (Tayabas, Lucban), on *Gossypium*;

71) *H. aspidistræ* (Signoret), at Luzon, on *Erythrophalum scandens* (Laguna, Los Baños); on *Piper* (Benguet, Baguio);

72) *Pinnaspis siphonodontis*, Cockerell and Robinson, at Luzon (Laguna, Los Baños), on *Celtis philippinensis*, *Sandoricum koetjape* and *Siphonodon celastrines*;

73) *P. buxi* (Bouché) at Luzon (Laguna, Los Baños), on *Homalonema philippinensis*;

There follows a list of the host-plants and the coccids living on them, and finally the writer gives explanations of the scientific terms used in the course of the systematic descriptions of the insects.

1254 - Disease of Bacterial Origin Observed in *Sparganothis pilleriana*, in France. — DAUMÉZON, G., in *Bulletin de la Société de Pathologie végétale de France*, Vol. IV, No. 1, pp. 8-10. Paris, 1917.

In a vineyard at Aramon (Aude), the tegument of some larvae of *Sparganothis pilleriana* Schiff. which had already reached the last moulting stage, was found to be brownish and soft and the movements of the larvae were weak. When taken to the laboratory they died before the pupal stage was reached.

An examination of the blood of one of these larvae while it was yet alive, showed the presence of numerous slightly ovoid bacteria, about  $1.5\mu$  in diameter. The diameter increased somewhat in later cultures on artificial media, but the bacteria never really had the appearance of rods, and chains of more than four or five microorganisms were never formed.

The bacteria, described biologically in this preliminary note, resemble the microorganisms causing "flacherie" in the silkworm, and various types of pneumococci and enterococci.



1255 - Observations on *Meigenia floralis*, a Dipterous Parasite of the Lucerne "Negril" (*Colaspidema atra*), in France (1). — LÉCAILLON, in *Comptes rendus des séances de l'Académie d'Agriculture de France*, Vol. III, No. 30, pp. 881-885. Paris, 1917.

According to observations made at Bordeaux, Montpellier and Toulouse, in 1914, the larva of the tachinid *Meigenia floralis* Meig., lives as an internal parasite of the larva of the chrysomelid beetle *Colaspidema atra* Latr. and causes its death.

In studying the effectiveness of the parasite, the first question to answer was to determine if *M. floralis* appeared early enough and lived long enough to be able to lay its eggs on the series of *C. atra* larvae that attack lucerne from May 10 to 15 till July 10 to 15. The observations made in 1914, 1916 and 1917, show that *M. floralis* only commences oviposition in the first days of June, but can also oviposit after the time at which the last *Colaspidema* larvae have left the lucerne. Moreover a 2nd generation of *Meigenia* appears before the end of June and can attack the *Colaspidema* larvae, then in abundance. Practically, it may be said that the *Colaspidema* larvae are little, if at all, parasitised at their first appearance, whilst they are parasitised to a considerable proportion at the time when they begin to be rare (the number of parasitised larvae thus varies from 1 to 2 % up to 70 %).

Many *Colaspidema* larvae, especially at the end of June and beginning of July, when the parasite is very plentiful, usually contain more than one *Meigenia* egg (very often 2 or 3, even more and sometimes as many as 12), although the larvae cannot provide food for more than one parasite.

In various regions, the lucerne fields attacked by *Colaspidema* contain larvae parasitised in extremely variable proportions.

It is well known that *M. floralis* parasitises the larvae of the asparagus beetle (*Crioceris asparagi*). In studying, in a locality near Toulouse, the parasitism of *Meigenia* which was attacking *Colaspidema* in a lucerne field on the one hand, and the larvae of *Crioceris asparagi* in an asparagus field on the other, the author found complete uniformity in both cases. PAUTEL's work on *Meigenia* as a parasite of *Crioceris* can be equally applied to the case of *Colaspidema*. But in the case of *Crioceris*, there is at least a third generation of *Meigenia* which can attack the *Crioceris* larvae, which remain on the asparagus much longer than do the *Colaspidema* larvae on the lucerne. Again, *Crioceris*, in ranging more to the north than *Colaspidema*, is followed and attacked by *Meigenia* up to the Oise and probably further north still. The existence of *M. floralis* may be said to depend more on that of *Cr. asparagi* than that of *Colaspidema*. If *Meigenia* did not attack other insects than *Colaspidema*, its third generation could not develop and the dipteran would disappear. The presence of *Cr. asparagi* is, therefore, essential to the maintenance of the parasite in a given region.

*M. floralis* annually destroys a large number of *Colaspidema*. In spite of this, the latter never becomes so rare as to cause but insignificant damage;

(1) See also *B.*, April 1913, No. 434.

(Ed.)

as is agreed by the agriculturists of the Haute-Garonne district. It might be advisable to attempt to increase the destructive capacity of *M. floralis*. The writer has shown that it is easy to distinguish parasitised larvae of *Colaspidema* and *Crioceris*, for they carry the eggs of *Meigenia* fixed on their body for some days. The eggs are white and easily seen with the naked eye. Parasitised larvae can be quickly and easily captured, and they are, moreover, usually sufficiently grown so as to have no further need of nourishment. They could easily be carried in any suitable box. About twenty days pass from the time the egg is deposited on the host-larva to when the adult *Meigenia* emerges from the dead body of its host. The parasite could, therefore, be easily taken from a locality where it occurs in abundance to one where it is uncommon.

It would doubtless be advantageous to grow asparagus in those districts where *C. atra* is harmful, as this plant, being the host-plant of *Crioceris*, would afford shelter to the last generation of *Meigenia* and allow the parasite to pass the winter until the next season.

1256 - The Ant *Dolichoderus bituberculatus* in the Control of Pests of the Cocoa-tree, in Java (1). — GOOT, P. VAN DER, in *Mededeelingen van het Proefstation Midden Java*, No. 25, pp. 1-142. Batavia, 1917.

Ants, especially the three species "gramang" (*Plagiolepis longipes* Jord.), "nanggrang" (*Oecophylla smaragdina* Fabr.), and "black" (*Dolichoderus bituberculatus* Fabr.), play an important part in extensive cultivation in central Java.

Having recently published his studies on the "gramang ant" the author now describes the importance of the "black ant" in cocoa-tree plantations. Towards 1908 certain cocoa growers in Java noticed that, in plantations infested with "black ants", the damage done by *Helopeltis* was less. The introduction of large numbers of these ants into the cocoa-tree plantations was, therefore, advised, but as, during the following years, *Helopeltis* was less active, this advice was hardly followed; flaming the trees attacked and catching the insect sufficed to keep the pest under.

During the last few years *Helopeltis* again spread, and its attacks became disastrous. For this reason the author again studied the action of ants on *Helopeltis* and *Acrocercops cramerella* Sn., which gnaws the pods.

The "black ant", a species of *Dolichoderus* of which there are five types in Java, is distinguished, not only by special morphological characters, but also by the fact that it never seeks shelter under the soil, as do other more or less dark ants found in the plantations. The life cycle of the ant is described in detail.

The "black ant" greedily eats the sweet substance secreted by *Pseudococcus crotonis* which is found on the pods and young shoots of the cocoa-tree. It rarely seeks other food if there is an abundance of these coccidae; it does not remove them, but incessantly enters the colonies and carries away the sugar to its nest, made of the remains of dead leaves.

(1) See also R. Nov., 1916, No. 1249; R. May, 1917, No. 597, R. June, 1917, No. 614; No. 1259 of this Review. (Ed.)



By experiments in breeding cages it was possible to determine the part played by the ant in preventing *Helopeltis* from attacking the fruit or young stalks. The ant does not attack *Helopeltis* directly, but, by worrying it, prevents it from making a hole in the shell of the pod; its incessant visits exhaust the *Helopeltis*, which finally goes away, leaving the pod intact. Under a cage, where escape is impossible, *Helopeltis* dies. Worried by the ant, *Helopeltis* hardly finds a moment's respite in which to lay its eggs.

The part played by the "black ant" in the control of *Helopeltis* is closely connected with the presence of *Ps. crotonis*. The author shows the necessity, not only of transporting the ants into the plantations by removing the nests and offering suitable shelters made with dry leaves or the internodes of bamboo, but of also placing the *Pseudococcus* on the trees; this may be done by placing parts of pods infected by the *Pseudococcus* among the branches of trees which are still immune.

*Acrocercops cramerella* Sn. is another serious pest of the cocoa-tree. The larvae which hatch from the eggs laid on the shell of the pod, make their way to the inside, where they soon spoil the seeds. Although the "black ant" does not radically prevent the attacks of *Acrocercops*, it greatly reduces the damage done by it. The ants follow *Acrocercops*, worrying it continually, but, as this insect lays its eggs while moving over the fruit, some remain fixed on the pods. The "black ant" is, therefore, an insufficient means of controlling *Acrocercops* and for this reason, the gathering of all the fruit, ripe and green is advised.

The presence of ants protects the *Pseudococci* against the attacks of parasitic insects (wasps, etc.) thus allowing them to propagate rapidly.

The morphology and biology of *Ps. crotonis* are described, and its parasites enumerated, among them *Diplosis* sp., a chalcid, *Scymnus* sp. and *Spalgis epius*. *Pseudococcus crotonis* sucks the shell of the pod, so that part of the nutritive substance of the plant goes as food for the coccid instead of being used for the good of the organs of the plant. They, therefore, harm the plant, but to a minimum extent, and the combination of *Ps. crotonis* with the "black ant" is so advantageous for the cocoa-tree in controlling *Helopeltis* and *Acrocercops* that it is advisable to introduce the "black ant" into cocoa plantations wherever *Helopeltis* is active.

1257 - *Willistonina exuriens*, a Tachinid Parasite of the Lepidopteron *Automeris janus* in the Island of Trinidad, Antilles (1). — URICH, F. W., in the *Bulletin of the Department of Agriculture, Trinidad and Tobago*, Vol. XVI, Part. I, pp. 21-22. 1 plate with 4 fig. Port of Spain, 1917.

Sir N. LAMONT reared from pupae of *Automeris janus* a fly which has been determined as *Willistonina exuriens*.

The writer briefly mentions the habits of the *Tachinidae* (the family to which the above-mentioned parasite belongs) and also the systematic characters of the latter. Its larvae live in the body of the caterpillar of the moth,

(1) See on this subject No. 1260 of this Review.



and the pupae are formed in the pupal covering of their host. From one *Automeris* pupa which measured about 2 inches, 9 individuals of *Williston* issued.

1258. — **Patents for the Control of Diseases and Pests of Plants.** — See No. 1211 of this Review.

INSECTS, ETC.,  
INJURIOUS  
TO VARIOUS  
CROPS

1259 — *Araeocerus fasciculatus*, a Coleopteron Injurious to *Tephrosia candida*, in Java. — GOOT, P. VAN DER, in *Mededeelingen van het Proefstation Midden-Java*, No. 26, pp. 1-36. Batavia, 1917.

*Tephrosia candida* is of importance among the plants used as green manure for the various crops in the mountain district of Java, but satisfactory cultivation of this plant is hindered by a coleopteron which attacks the fruit, so that it is almost impossible to gather a sufficient quantity of sound seeds for sowing. A description of the morphology and biology of this insect is given.

The insect belongs to the *Anthribidae* family and has been identified as *Araeocerus fasciculatus* De Geer. The females measure from 4 to 4.5 millimetres, the males from 3.8 to 4.2 millimetres. The female lays its eggs in the half ripe, or nearly ripe, pods of *Tephrosia* when the seeds are already of a good size. The insect first gnaws a hole through the pod, then passes its ovipositor through the hole so as to lay an egg near a seed.

After 6 or 7 days the young larvae hatch and begin almost immediately to eat the seed; 23 to 29 days later the larvae pupate. The pupal stage lasts about 7 or 8 days, after which the adult insect emerges. About 6 days later the insect gnaws through the wall of the pod and flies away. After another 10 days or so the insect may start laying again. Every female may lay during about 25 days, giving a maximum of 84 eggs.

Since the different stages through which the insect passes require from 38 to 44 days and laying begins 12 days after, one insect may produce 6 to 7 generations in a year.

With a production of 30 eggs and a 50 % mortality, the descendants in one year would amount to 260 000 females, since the number of females produced about equals that of the males. The insect can feed on anything that is not too hard, it travels easily and a flight of over 1000 yards does not seem impossible for the adults.

In one plantation only 5 % of sound seeds were found; in another, where *Tephrosia* is specially well tended, 75 % of the seeds were attacked. Other Leguminosae have been found to be attacked by *Araeocerus* in the same way. *Crotalaria striata*, *Soya hispida*, *Indigofera* sp. and *Cassia occidentalis* are quoted as host-plants. The wide distribution of these plants makes the control of *Araeocerus* very difficult. The insect is attacked by certain parasites, among them *Aximopsis javensis* Girault, *Eupelmus javae* Girault, and two species of Braconidae, but these two parasitic hymenoptera, although widespread, can hardly check the ravages of *Araeocerus*.

Other means of control are discussed, in the first place treatment with 1 % Paris green. As, however, *Tephrosia* continually produces new fruit, repeated treatment is needed, thus making the method too costly.

In order to control indirectly the *Araeocerus*, the introduction of the black ant (*Dolichoderus bituberculatus*) together with *Pseudococcus crotonis* into *Tephrosia* plantations is recommended (1). In a plantation in which these ants were found 64 % of healthy seeds were obtained, whereas another, in which there were no ants, only gave 35 %.

Another method consists in pruning the bushes from time to time. The fruit of *Tephrosia* takes 70 days to ripen; the females of *Araeocerus* live, on an average, 64 days, at the most, 81. By cutting *Tephrosia* in such a way that fructification is prevented during 140 days, the females of *Araeocerus* will be unable to lay their eggs in the *Tephrosia* and will die. After the second pruning the plant may be allowed to fructify and a practically immune crop will be obtained.

1260 - *Automeris Janus*, a Lepidopteron Living on Cacao and on *Erythrina* spp. in the Island of Trinidad, Antilles. — LAMONT, NORMAN, in *Bulletin of the Department of Agriculture, Trinidad and Tobago*, Vol. XVI, Part. 1. p. 21, fig. 1-3 of the plate. Port of Spain, 1917.

*Automeris janus* is one of the largest and most beautiful lepidoptera of Trinidad; it is found commonly in the month of February on *Erythrina* (immortel), and cacao trees. In confinement it eats the leaves of either cacao or the coral tree (*Erythrina umbrosa* and *E. velutina*), but seems to prefer those of the cacao. In the natural state, however, it is found more frequently on the coral tree. The probable reason of this is that the rough bark of *Erythrina* suits the larva better than the smoother bark of the cacao for spinning its cocoon upon.

Owing to the size of the insect, its wide distribution, and its method of living on both cacao and immortal, it would cause much more damage in the island, were it not for the fact that it is kept in check by a parasite. Of 24 *Automeris* larvae reared by the writer, only one succeeded in completing its transformation into the perfect insect. All the others were attacked by a fly, and the pupa cases of *A. janus* were packed full of the pupae of this fly.

1261 - *Lasioderma serricorne*, a Coleopteron Injurious to Tobacco and other Plant Products, at Deli, Sumatra (2). — BUSSY, L. P. DE, in *Mededeelingen van het Deli Proefstation*, Year X, pp. 129-157. Medan, 1917.

*Lasioderma serricorne* is an insect found everywhere where tobacco is prepared for the market, and also among numerous other plant products. A long list is given of the stock of native shops capable of giving this insect sufficient food and an environment favourable to its propagation; first of all comes tobacco, then various species of leguminous seeds, those of *Carum Carvi* and *Coriandrum salivum*, maize, rice and flour.

The life of the insect, which is dependent on the temperature and the food, lasts, at Deli (Sumatra), from 6 to 9 weeks. The number of genera-

(1) On this subject see No. 1256 of this Review.

(2) See also B. Nov., 1914, No. 1081; R. May, 1916, No. 590; R. June, 1916, No. 711. (Ed.)



tions also varies a great deal with the conditions under which the female lives.

Strong measures have had to be taken at Deli to suppress this pest. The holes which the insect bores in the tobacco leaves greatly decrease their value. Fortunately carbon bisulphide has been found to be a satisfactory means of disinfection.

The methods of applying carbon bisulphide are described in length. Preference is given to the use of an hermetically closed room in which are placed the balls of tobacco and dishes containing carbon bisulphide; contact must be carefully avoided; 300 cc. of carbon bisulphide are sufficient to disinfect 1 cubic metre (35.316 cubic feet). The tobacco is left 1 or 2 days in the disinfecting room and then subjected to aeration in a place where new infection is impossible. As soon as all traces of carbon bisulphide have disappeared, the tobacco, which has undergone no change in taste or colour, may be sent away.

Radical disinfection of the fermentation sheds is essential. An inspection of all goods which may shelter the insect in the neighbourhood of the sheds is necessary to check the pest and prevent its spread.

1262 — *Tarsonemus pallidus*, a Mite Injurious to Geraniums and Other Plants in Maryland, U. S. A. (1). — GARMAN, P., in *The Maryland Agricultural Experiment Station, Bulletin* No. 208, pp. 327-342, fig. 1-13. College Park, Md., 1917.

*Tarsonemus pallidus* Banks not only causes great damage to cyclamens and snapdragons in Maryland, but also attacks chrysanthemums, fuchsias and geraniums. It appears to have been recorded first on geraniums in 1915 near Baltimore. It should be noted that the female of a species of *Tarsonemus* identical with *pallidus* has been found on linden trees at Maryland State College.

Because of the great injury caused by this mite to other plants, the Author offers the term *pallid mite* in place of the usual term — *cyclamen mite* — on account of its brevity, descriptive power and wider application than the latter name.

Injury to geraniums by the parasite is sometimes severe. If the mites are numerous, the attack causes the leaves to curl, spot and drop prematurely. The injury may be recognised before the mites are observed by the appearance of scorched spots on the underside of the leaves. Mites are usually present, however, before the injury becomes apparent. Plants heavily infested have been known to lose all their leaves, the leaves being frequently invaded by fungi before falling from the stem. The injury to heavy wooded varieties is less pronounced, but the mites usually cause the scorched appearance previously mentioned. Injury is most severe when the plants are crowded, the leaves in contact and the humidity high. If the plants are well spaced, the injury is seldom serious and the mites disappear or are greatly reduced in numbers in a short time.

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(1) See also R., October 1917, No. 983.

(Ed.)



Most varieties of geraniums are attacked by *Tarsonemus pallidus* but a few seem to be resistant. The following varieties have been observed to become infested, or have been infested by artificial means: Le Pilote, Jean Vaud, S. A. Nutt, Alphonse Richard, Madam Kowalevski, Baron Grubisch, Maryland, Beauté Poitevine, Mme. Landry and others. Infestation of I. a Favorite, a white variety, was obtained with difficulty, although the plants were kept in contact with other varieties that were heavily infested.

Deformation and curling of the leaves as a result of mite injury is much greater in the case of cyclamen and snapdragon plants than geranium. Cyclamen flowers are also attacked frequently, the flowers withering and curling in much the same manner as the leaves.

After having described the life history and habits of the mite, the writer considers various measures for controlling the pest.

Bordeaux mixture may be safely used on geraniums and will doubtless kill the pallid mite. Discolouration of the foliage results as with lime-sulphur, thus rendering the preparation of doubtful importance to growers. Various of the insecticides experimented with were found to injure the leaves and were therefore discarded. Injury due to treatment with chromic and picric acid is slow in appearing and it is possible that a thorough watering of the plants on the day following treatment will reduce injury to a negligible factor. Small tests with nicotine extract ("Black-leaf 40") seem unfavourable on the whole, but it is probable that nicotine has some repellent action and should prove valuable as a preventative. A stream of pure water will dislodge *Tarsonemus* more readily than red-spider (*Tetranychus telarius*) because of the fact that the former spins no web. With geraniums, this method of control is available because the leaves do not curl sufficiently to hide the insect as is the case with snapdragons, and frequent syringing from below will, it is thought, prove effective. For isolated plants or small beds, it is recommended that they be well spaced so that no migration may take place from plant to plant and that as much light and air be provided as possible. Under these conditions no trouble should be experienced from injury by the pallid mite.

## INJURIOUS VERTEBRATES.

1263 - *Agelaius icterocephalus*, a Bird Injurious to Rice in the Island of Trinidad (Antilles). — F. W. U[RICH] in *Bulletin of the Department of Agriculture, Trinidad and Tobago*, Vol. XVI, Part. I, p. 24. Port of Spain, 1917.

It appears from observations in the rice fields in the district of Oropuche, that the yellow headed Caciques (*Agelaius icterocephalus*) swoop down in flocks of as many as 200 as soon as the rice seed is sown for making nurseries and pick up the grain. Until about 10 or 14 days after sowing, the nursery is not safe from these birds, for they readily pull up the recently rooted seedlings which they leave to wither on the ground as soon

as they have detached the seed. After the period just mentioned, the small plants have usually become too strong to be easily pulled up, and are not interfered with any more.

After giving LEOTAUD's description of *A. icteroccephalus* and describing the habits of the latter, the writer draws attention to the fact that this bird is insectivorous, and therefore useful in spite of the injury it does to the rice nurseries. It should therefore not be killed, and as it is destructive to rice for only the first fortnight after sowing, the best plan would be to protect the nurseries, which are not as a rule very extensive, by means of covers of wire netting, or any cheap light cloth.

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## THE INTERNATIONAL INSTITUTE OF AGRICULTURE

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## SYNOPSIS

1. The purpose of this study is to determine the effect of the

### 2. EFFECT OF TEMPERATURE ON THE

3. rate of reaction between the two substances.

4. The results of the experiment are as follows:

5. At a temperature of 20°C, the rate of reaction is

6. found to be 0.05 moles per liter per second.

7. At a temperature of 30°C, the rate of reaction is

8. found to be 0.10 moles per liter per second.

9. The results show that the rate of reaction increases

## P R E F A C E

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This index, though arranged alphabetically, retains the grouping of the subjects used in the *International Review*. The arrangement of the subjects in each group is in chronological order of publication, except in the case of those relating to Agricultural Development, where the alphabetical arrangement was considered more useful.

Except in the case of the original articles, which are numbered according to their pages, the numbers of each subject refer to the paragraphs in the *International Review*.

The index consists of three parts: one, of the original articles, one concerned only with Agricultural Intelligence and the last with Plant Diseases.

This year there is included the table used for the conversion in the *Review* of the Weights, Measures and Money values of the various countries to the Metric System.

This volume of contents has been prepared by the rédacteur Dr. Giulio Provenzal.

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# IV. — WEIGHTS, MEASURES AND MONEY OF THE VARIOUS COUN- TRIES WITH THEIR ENGLISH EQUIVALENTS.

1 Archine (Russia)	= 27.99961 inches
1 Ardeb (Egypt)	= 5.44435 bushels
1 Ardeb of wheat (Egypt)	= 2.95264 cwt.
1 Ardeb of hulled maize (Egypt)	= 2.75580 cwt.
1 Ardeb of barley (Egypt)	= 2.36211 cwt.
1 Ardeb of undecorticated rice (Egypt)	= 5.72812 cwt.
1 Ardeb of decorticated rice (Egypt)	= 3.83813 cwt.
1 Arpent (Canada)	= 0.84501 acre
1 Are [100 square metres]	= 107.63915 square feet
1 Arroba (Brazil)	= 33.06951 lbs.
1 Arroba (Cuba, Guatemala, Paraguay, Peru)	= 25.35841 lbs.
1 Arroba (Mexico)	= 25.36687 lbs.
1 Bale of cotton (Brazil)	= 396.83415 lbs.
1 Bale of cotton (United States)	= 4.46431 cwt. (gross wt.)
1 " " " " "	= 4.26788 cwt. (net wt.)
1 Bale of cotton (India)	= 3.57145 cwt.
1 Barrel of wheat flour (Canada, United States)	= 1.75001 cwt.
1 Bar, see Millier	
1 Bow (Java, Dutch Indies)	= 76.36998 square feet
1 Bushel (United States)	= 0.96896 bushels
1 Bushel of oats (United States)	= 32 lbs.
1 Bushel of oats (Canada)	= 34 lbs.
1 Bushel of wheat and potatoes (United States)	= 60 lbs.
1 Bushel of barley (Canada, United States)	= 48 lbs.
1 Bushel of raw rice (United States)	= 45 lbs.
1 Bushel of rye, hulled maize, linseed (Canada, United States)	= 56 lbs.
1 Cadastral arpent (Hungary)	= 1.42201 acres
1 Cental (United States)	= 100 lbs.
1 Centiare [10 square metres]	= 10.76392 square feet
1 Centigramme	= 0.15432 grains
1 Centilitre	= 0.0022 gallons
1 Centimetre	= 0.393715 inches
1 Centistere	= 0.35315 cubic feet
1 Centner (Germany, Austria, Denmark)	= 110.23171 lbs.
1 Centner (Sweden)	= 93.71238 lbs.
1 Cho [60 ken] (Japan)	= 119.30327 yards.
1 Cho (Japan)	= 2.45068 acres
1 Crown [100 heller] (Austria-Hungary)	= 10 d at par
1 Crown [100 öre] (Denmark, Norway, Sweden)	= 1s 1 1/2 d at par
1 Cubic centimetre	= 0.06102 cubic inch
1 Cubic metre	= 1.30795 cubic yards
1 Decagramme [10 grammes]	= 0.35275 oz.



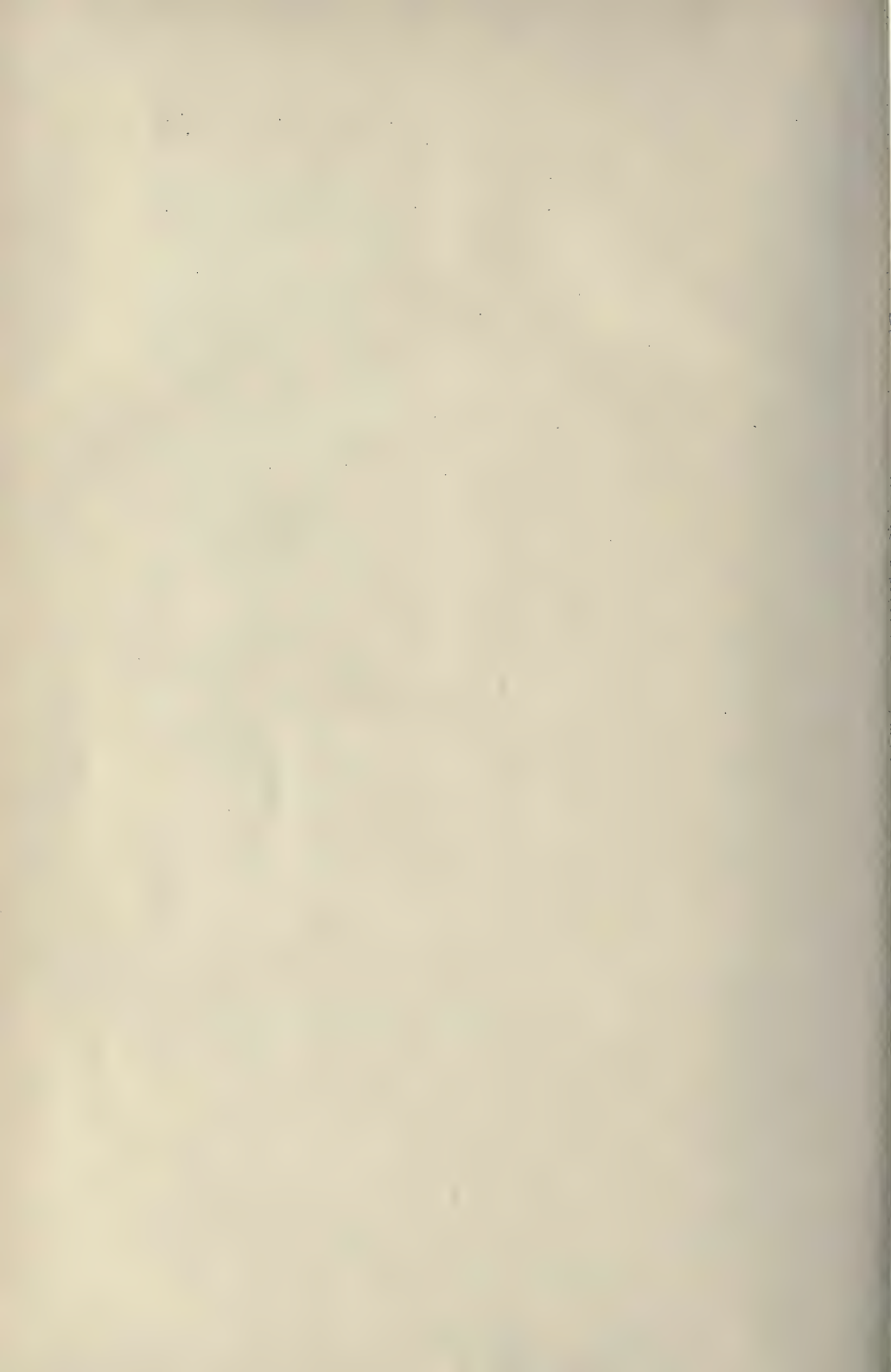
1 Decalitre [10 litres]	=	2.19976 gallons
1 Decametre [10 metres]	=	32.80840 feet
1 Decare [1000 square metres]	=	1195.98627 square yards
1 Decastere [10 cubic metres]	=	13.07951 cubic yards
1 Deciare [10 square metres]	=	11.95986 square yards
1 Deciatine [2 tchetwert] (Russia)	=	2.69966 acres
1 Decigramme	=	1.54323 grains
1 Decilitre	{	= 0.022 gallons
	{	= 0.0027497 bushels
1 Decimetre	=	3.93701 inches
1 Decistere	=	3.53146 cubic yards
1 Dinar, gold [100 para] (Serbia)	=	9 <sup>31</sup> / <sub>100</sub> d at par
1 Dollar, gold, \$ [100 cents] (United States)	=	4 s 1 <sup>1</sup> / <sub>10</sub> d at par
1 Drachm, gold [100 lepta] (Greece)	=	9 <sup>31</sup> / <sub>100</sub> d at par
1 Dz. = Doppelzentner (Germany)	=	220.46341 lbs.
1 Egyptian kantar (Egypt)	=	99.04980 lbs.
1 Feddan Masri [24 Kirat Kamel] (Egypt)	=	1.03805 acres
1 Florin, gold, or Gulden [100 cents] (Netherlands)	=	1 s 7 <sup>31</sup> / <sub>100</sub> d at par
1 Franc [100 centimes] (France)	=	9 <sup>31</sup> / <sub>100</sub> d at par
1 Gallon (United States)	=	0.83270 gallons
1 gramme	=	0.03527 oz.
1 Hectare [10 000 square metres]	=	2.47109 acres
1 Hectogramme (100 grammes)	=	3.52746 oz.
1 Hectolitre [100 litres]	{	= 21.99755 gallons
	{	= 2.74967 bushels
1 Hectometre [100 metres]	=	109.36133 yards
1 Hectostere [100 cubic metres]	=	130.79505 cubic yards
1 Jarra (Mexico)	=	7.22642 quarts
1 Kadastral hold; see Cadastral arpent	—	
1 Kin (Japan)	=	1.32278 lbs.
1 Kokou [10 to] (Japan)	=	1.58726 quarts
1 Kokou of oats (Japan)	=	1.55014 cwt.
1 Kokou of cocoons (Japan)	=	82.67268 lbs.
1 Kokou of wheat and maize (Japan)	=	2.58356 cwt.
1 Kokou of barley (Japan)	=	2.06685 cwt.
1 Kokou of naked barley (Japan)	=	2.69428 cwt.
1 Kokou of rice (Japan)	=	2.80501 cwt.
1 Kopek (Russia)	=	1 <sup>1</sup> / <sub>100</sub> farthing at par
1 Kwan (Japan)	=	8.26738 lbs.
1 Lei, gold [100 bani] (Rumania)	=	9 <sup>31</sup> / <sub>100</sub> d at par
1 Leu [100 statinki] (Bulgaria)	=	9 <sup>31</sup> / <sub>100</sub> d at par
1 Lira [100 centesimi] (Italy)	=	9 <sup>31</sup> / <sub>100</sub> d at par
1 Litre	{	= 0.21998 gallons
	{	= 0.0275 bushels
1 Manzana (Nicaragua, Guatemala)	=	1.72665 acres
1 Mark [100 Pfennige] (Germany)	=	11 <sup>3</sup> / <sub>4</sub> d at par
1 Mark [100 penni] (Finland)	=	9 <sup>31</sup> / <sub>100</sub> d at par
1 Maund Factory (India)	=	74.6709 lbs.

1 Maund Imperial (India)	= 82.28136 lbs.
1 Metre	= 3.28084 feet
1 Milliare	= 1.07639 square feet
1 Milligramme	= 0.01543 grains
1 Millilitre	= 0.00022 gallons
1 Millimetre	= 0.03937 inches
1 Millistere	= 61.02361 cubic inches
1 Myriagramme [10 000 grammes]	= 22.04634 lbs.
1 Myrialitre [10 000 litres]	} = 2 199.75539 gallons = 274.96701 bushels
1 Myriametre [10 000 metres]	
1 Millier [1 000 000 grammes]	= 6.21373 miles
1 Milreis, gold (Brazil)	= 19.68426 cwt.
1 Milreis, gold (Portugal)	= 2 s 2 <sup>11</sup> / <sub>100</sub> d at par
1 Minot (Canada)	= 4 s 5 <sup>19</sup> / <sub>100</sub> d at par
1 Morgén (Cape of good Hope)	= 1.07306 bushels
1 Muid (Cape of good Hope)	= 2.11654 acres
1 Oka (Greece)	} = 24 gallons = 3 bushels
1 Oke (Egypt)	
1 Peseta, gold [100 céntimos] (Spain)	= 2.75579 lbs.
1 Peso, gold [100 centavos] (Argentina)	= 2.75138 lbs.
1 Peso, gold [100 centavos] (Chili)	= 9 <sup>33</sup> / <sub>100</sub> d at par
1 Pic (Egypt)	= 3 s 11 <sup>37</sup> / <sub>100</sub> d at par
1 Pikul (China)	= 1 s 5 <sup>63</sup> / <sub>100</sub> d at par
1 Pikul (Japan)	= 2.46646 feet
1 Poud (Russia)	= 133.27675 lbs.
1 Pound, Egyptian, gold [100 piastres]	= 132.27805 lbs.
1 Pound, Turkish, gold [100 piastres] (Ottoman Empire)	= 36.11292 lbs.
1 Pund (Sweden)	= £1.0.6 <sup>43</sup> / <sub>100</sub> d at par
1 Quintal	= 18 s 0 <sup>51</sup> / <sub>100</sub> d at par
1 Rouble, gold [100 kopeks] (Russia)	= 0.93712 lbs.
1 Rupee, silver [16 annas] (British India)	= 1.96843 cwt.
1 Square metre	= 2 s 1 <sup>3</sup> / <sub>100</sub> d at par
1 Stere [1 cubic metre]	= 1 s 4 d at par
1 Sucre, silver (Ecuador)	= 1.19599 square yards
1 Talari [20 piastres] (Egypt)	= 1.30795 cubic yards
1 To (Japan)	} = 1 s 11 <sup>61</sup> / <sub>100</sub> d at par = 4 s 1 <sup>11</sup> / <sub>100</sub> d at par
1 Ton (metric)	
1 Verst (Russia)	= 0.49601 bushels
1 Yen, gold [2 fun or 100 sen] (Japan)	= 3.96815 gallons
1 Zentner (Germany)	= 0.98421 tons
	= 1166.64479 yards
	= 2 s 0 <sup>37</sup> / <sub>100</sub> d at par
	= 110.23171 lbs.



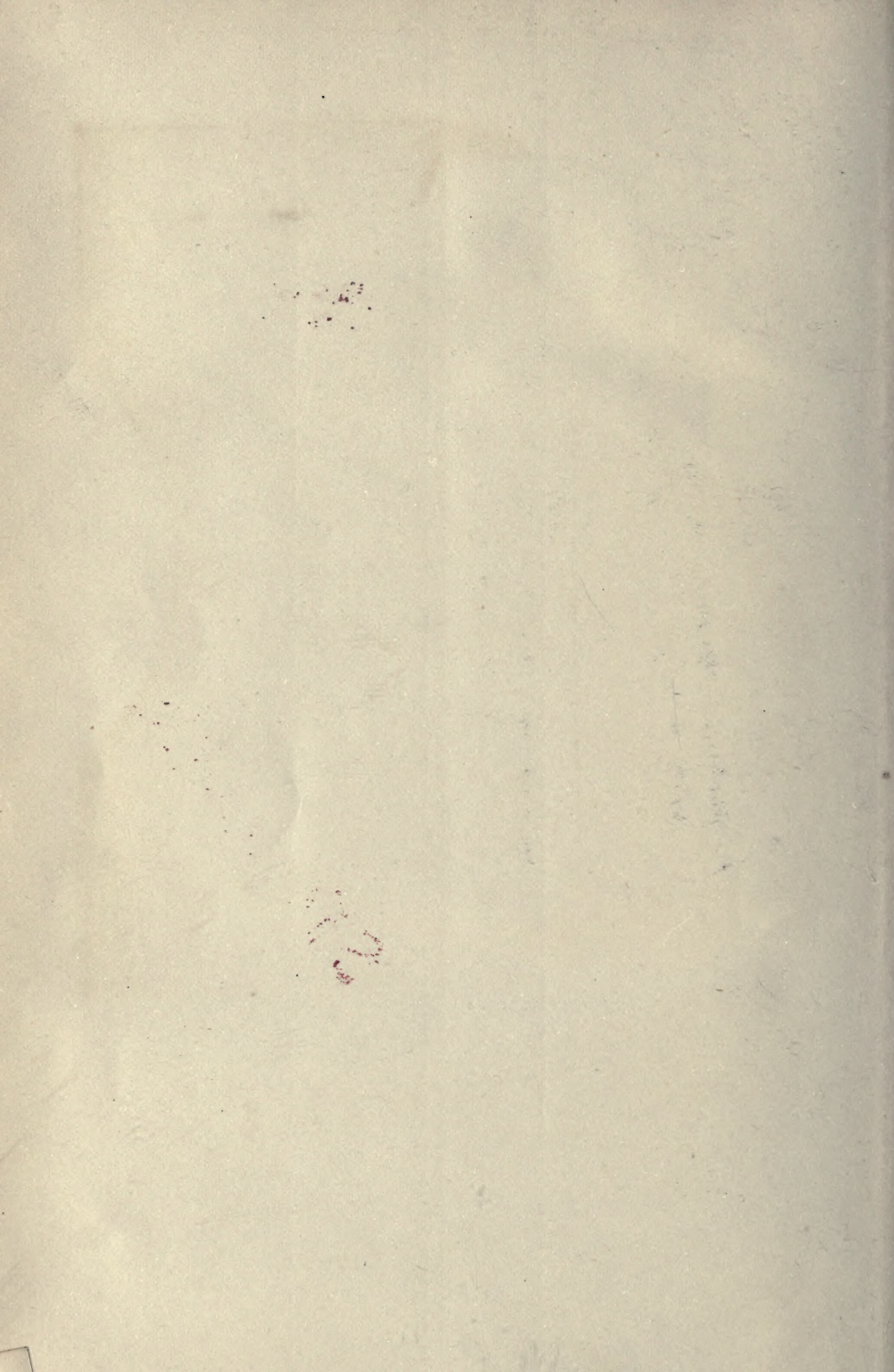












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